Radiology of cardiac diseases

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LECTURE OBJECTIVES:

- To list radiological exams used to image to the heart and mediastinal vessels.
- To list advantages and disadvantages of each exam in relation to heart and mediastinal vessels imaging.
- To Identify normal appearance of the heart and mediastinal vessels on each modality.

What radiological exams are used in imaging heart and mediastinal vessels?

- X ray
- Angiogram
- Echocardiogram
- CT scan
- MRI
- Nuclear scan

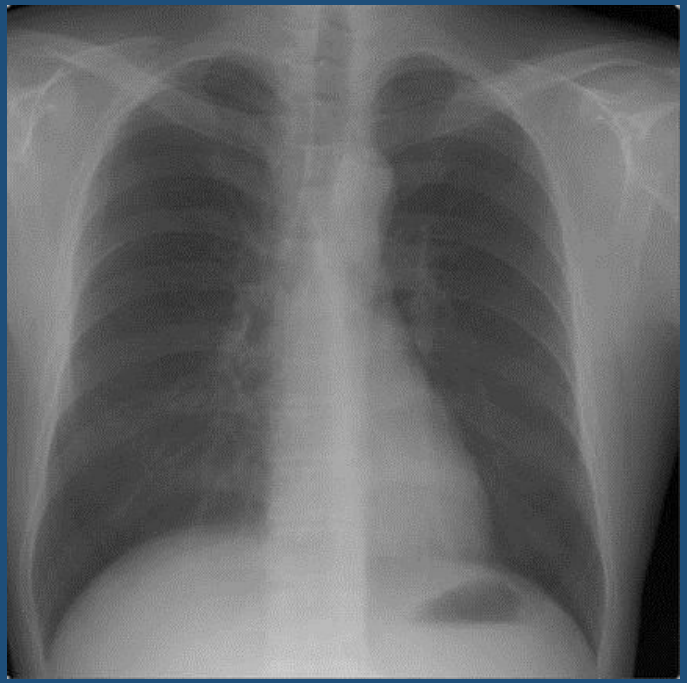
What radiological exams are used in imaging heart and mediastinal vessels?

- X ray
- Angiogram
- Echocardiogram
- CT scan
- MRI
- Nuclear scan

ALL ARE USED

X ray

Chest X ray = Radiograph = Plain film



Chest X ray

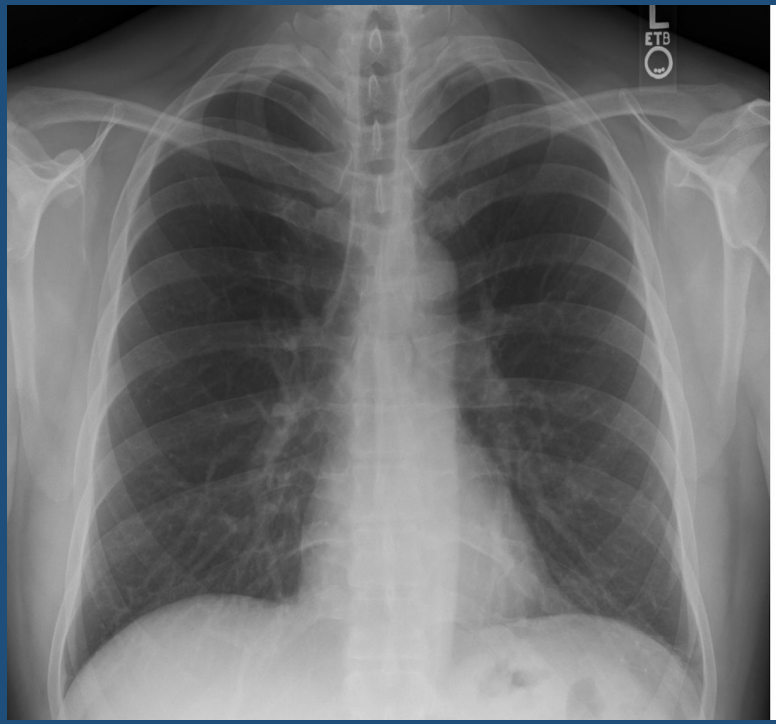
❑ ***Advantages :***

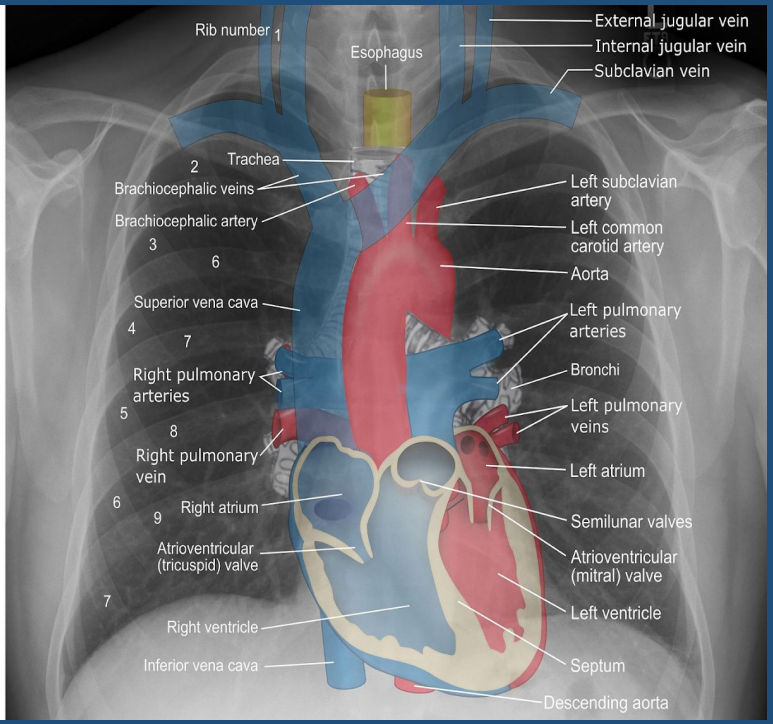
- ➢ Widely available, portable, cheap, easy to read.
- ➢ Proper in assessing heart size.
- ➢ Proper in assessing heart position (e.g. dextrocardia).
- ➢ Proper in assessing lung changes secondary to cardiac diseases (e.g. pulmonary edema).

❑ ***Disadvantages:***

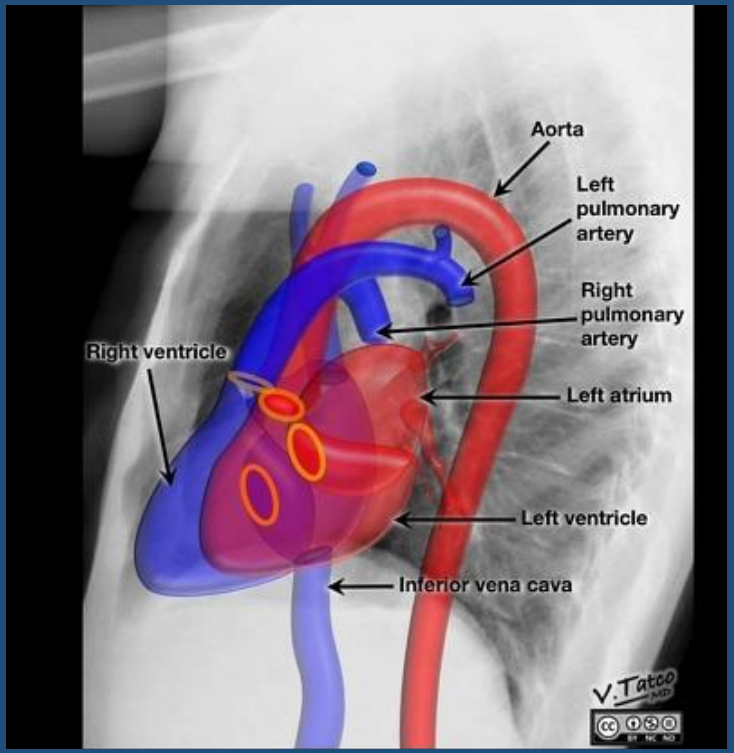
- ➢ Use Ionizing radiation.
- ➢ Limited assessment of heart cambers and myocardium.
- ➢ Limited assessment of heart valves (only when calcified).
- ➢ Limited assessment of pericardium.
- ➢ Limited assessment of mediastinal vessels.

Normal chest x-ray (Posterior–Anterior view)

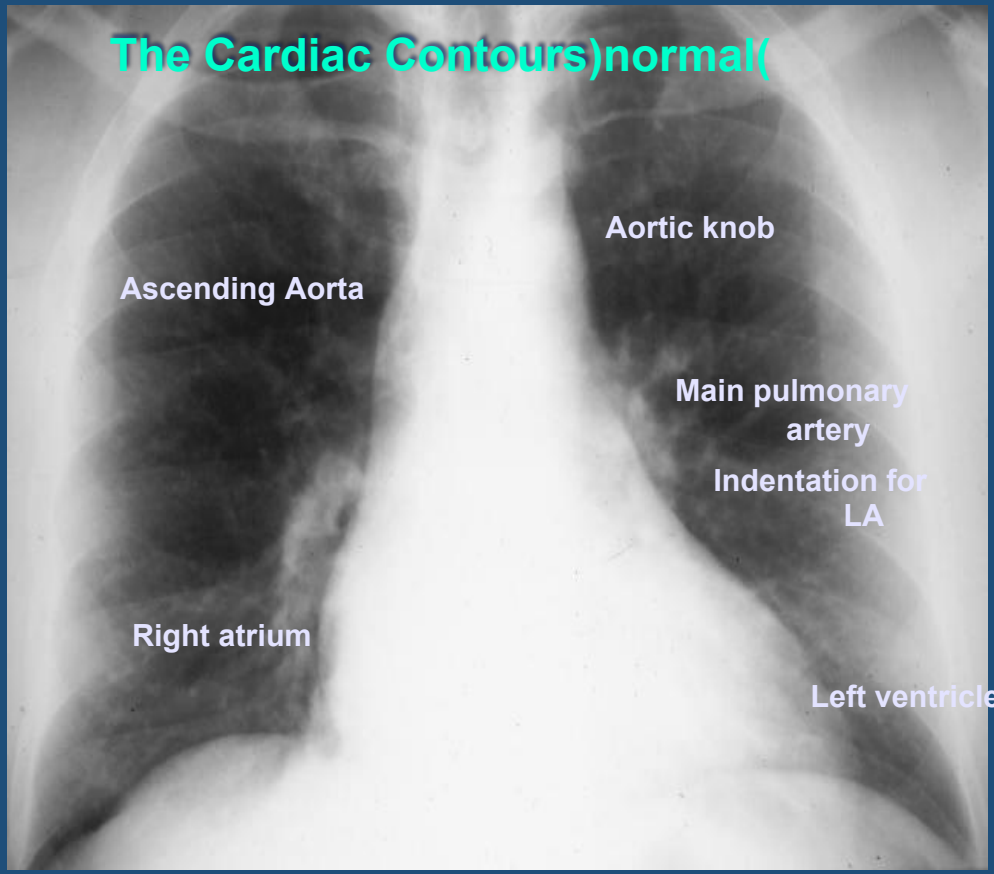




Normal chest x-ray (lateral view)



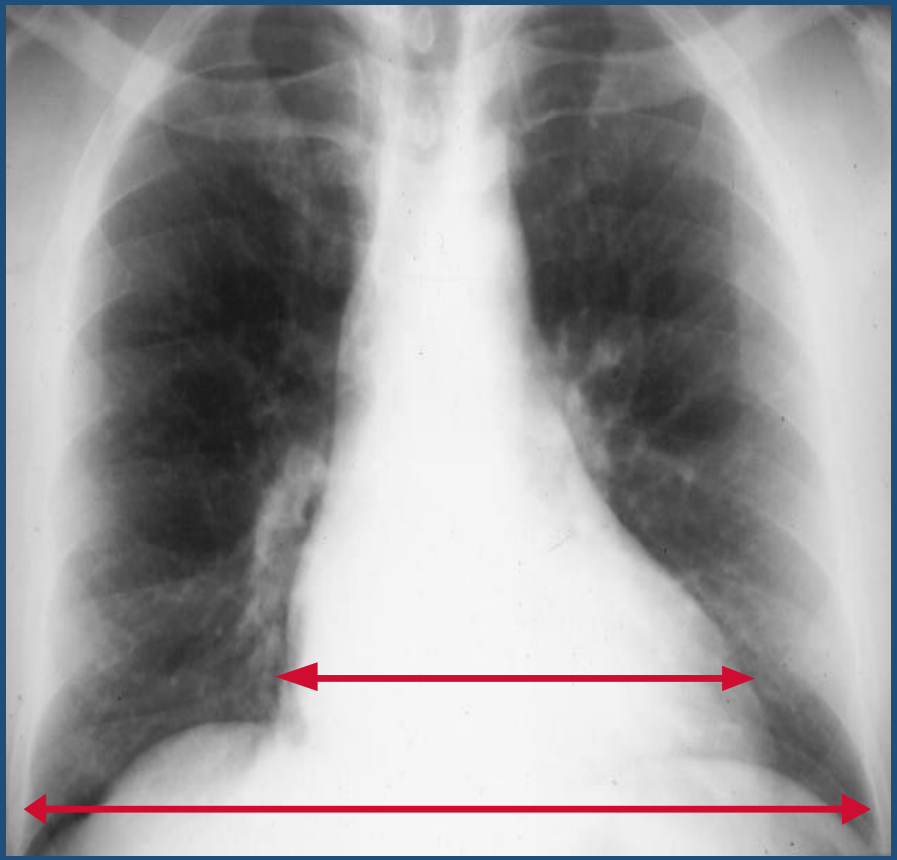
The Cardiac Contours)normal(



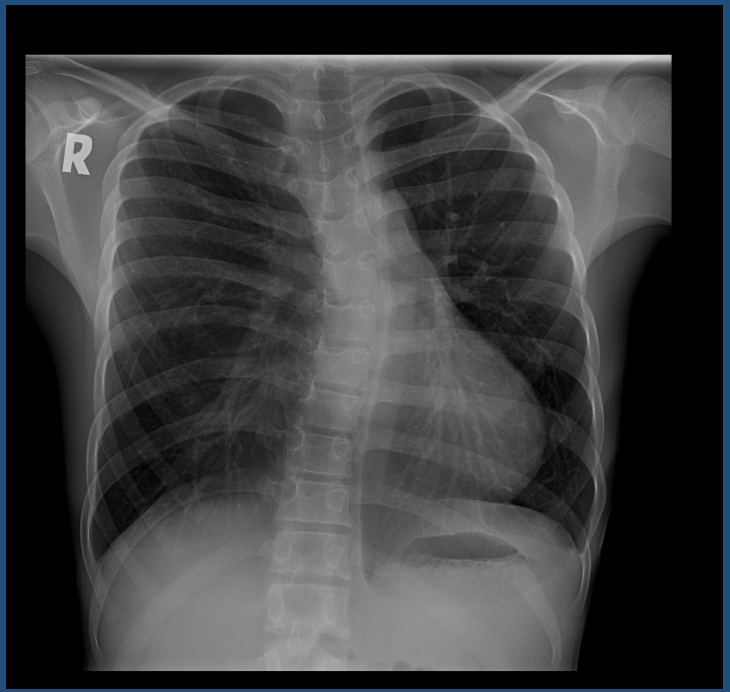
Cardio-thoracic Ratio

One of the easiest observations to make is something you already know: the cardio-thoracic ratio which is the widest diameter of the heart compared to the widest internal diameter of the rib cage

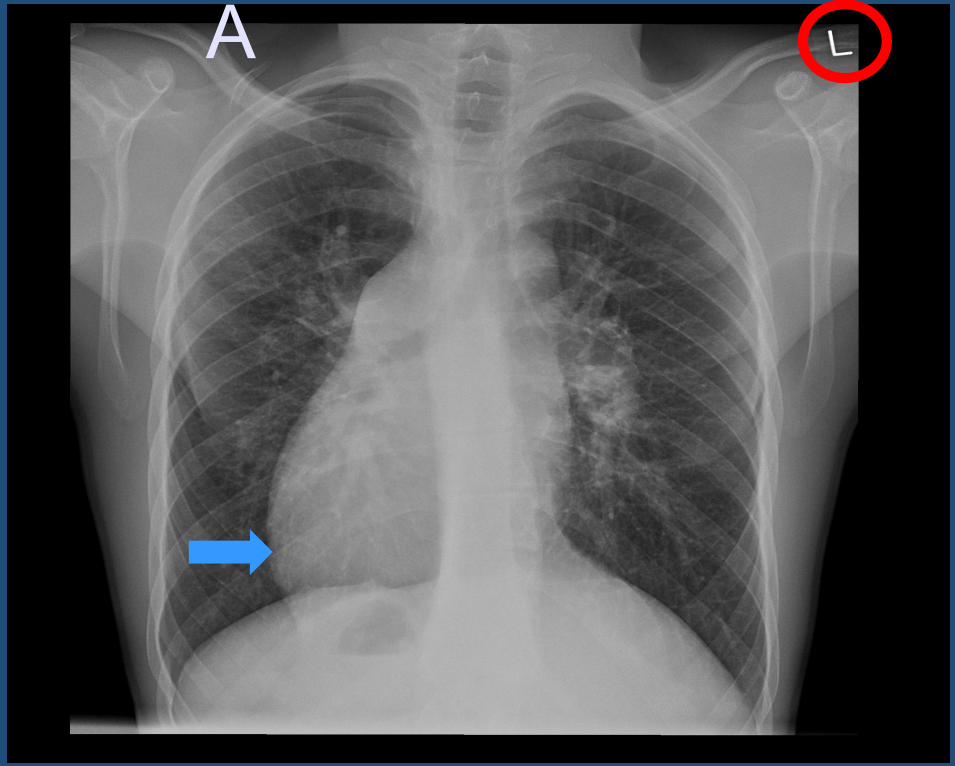
<50%



Cardiac displacement)**Pectus excavatum**(

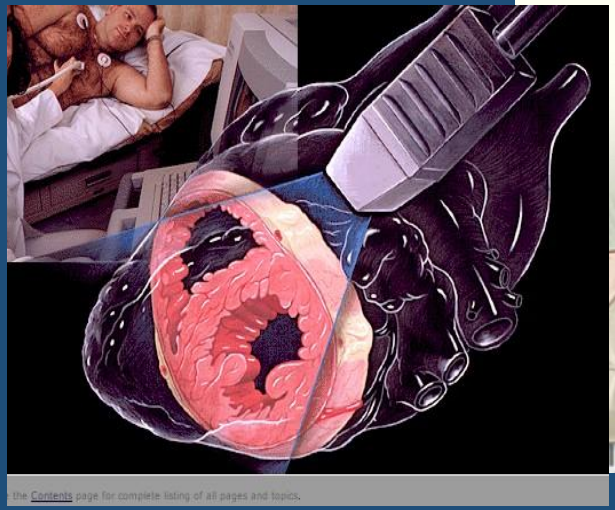


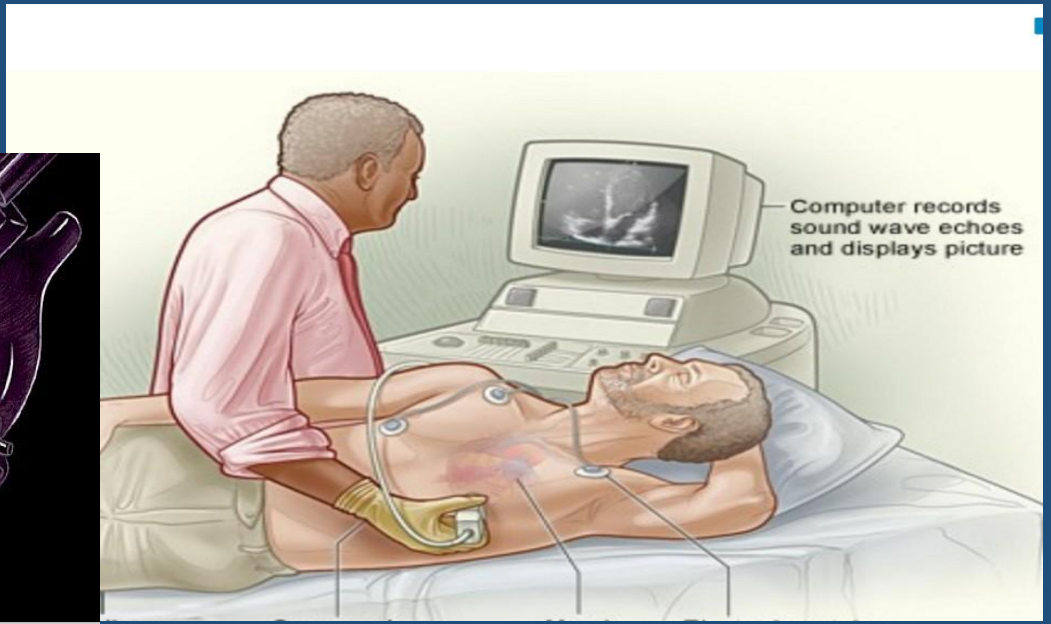
DEXTROCARDIA



Echocardiogram

Echocardiogram





Echocardiogram

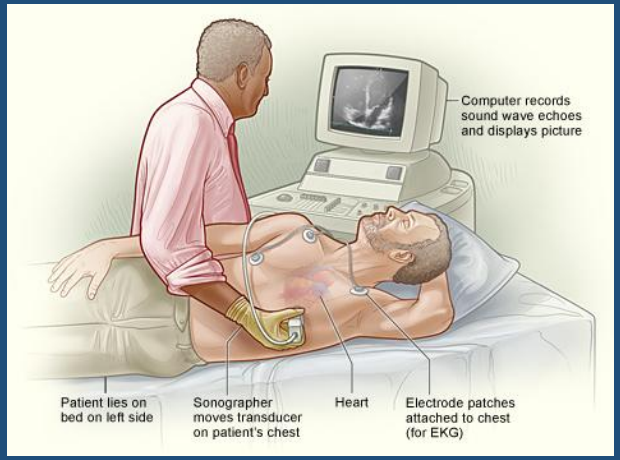
❑ ***Advantages:***

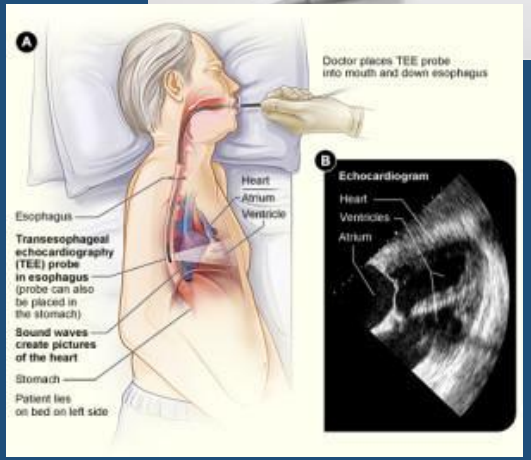
- ➢ No Ionizing radiation
- ➢ Widely available, portable.
- ➢ Proper in assessing heart morphology (cardiac chambers, myocardium and valves).
- ➢ Proper in assessing heart function (ejection fraction).
- ➢ Proper in assessing pericardial effusion.

❑ ***Disadvantages:***

- ➢ Operator dependent.
- ➢ Not proper to assess coronary arteries

Echocardiogram

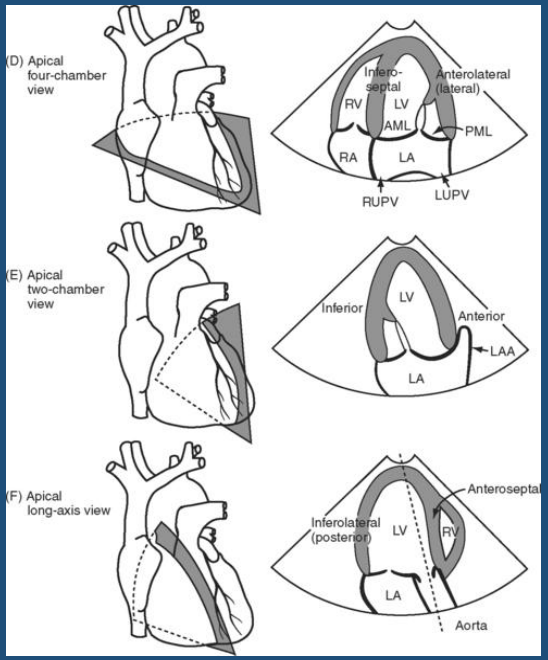


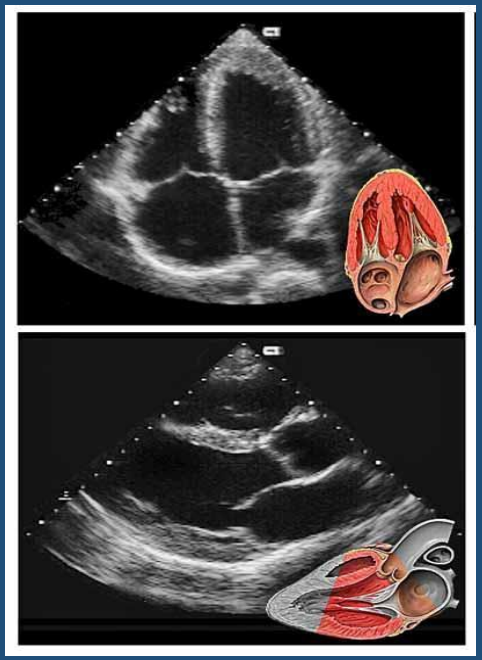


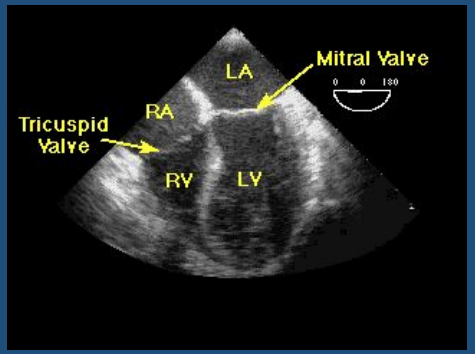
Trans-Thoracic

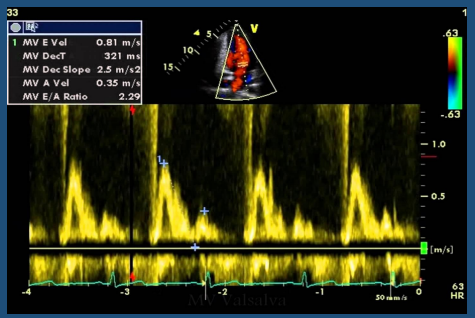
Trans-Esophageal

Echocardiogram (normal)









Angiogram

Angiogram= x-ray + I.V. contrast

Angiogram

Cardiac catheterization: assessment of coronary arteries and left ventricle.

Aortogram: assessment of aorta and main branches.

Pulmonary angiogram: assessment of pulmonary arteries.

Angiogram

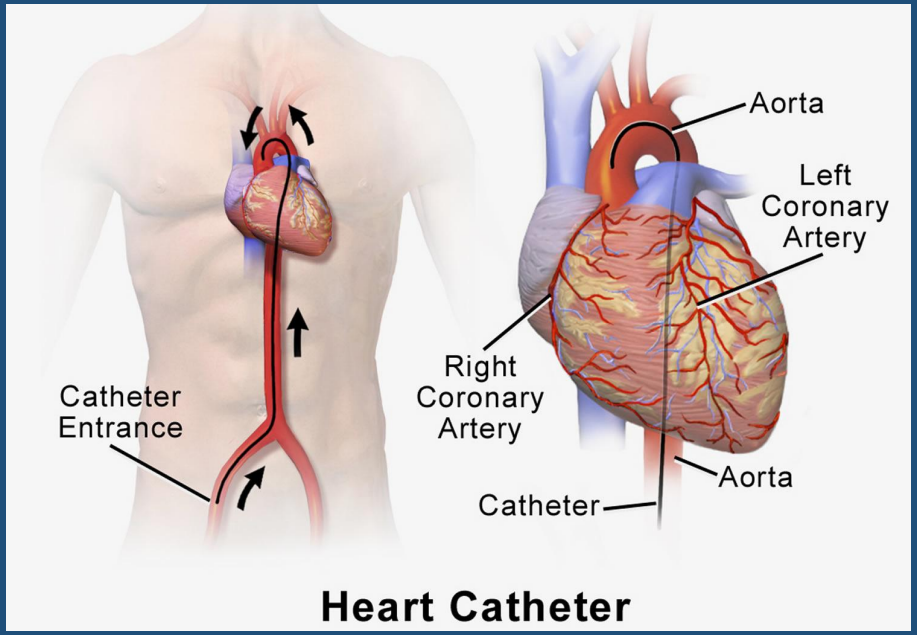
❑ ***Advantages:***

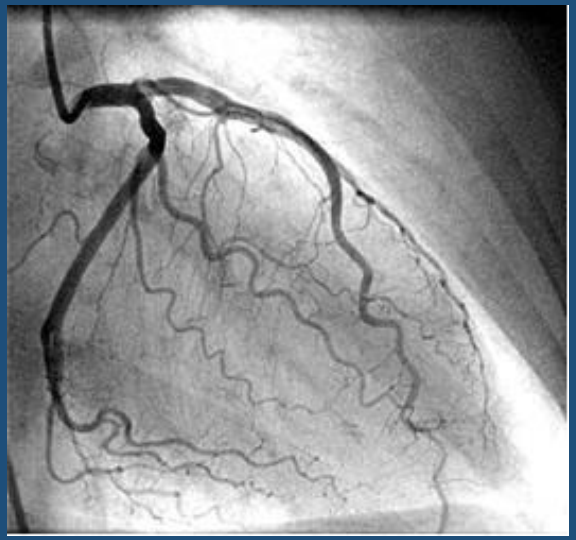
- ➢ Minimal invasive procedure and can replace surgery.
- ➢ Proper in assessing and treating coronary stenosis.
- ➢ Proper in assessing left ventricle.
- ➢ Proper in assessing and treating aortic dissection or aneurysm.
- ➢ A treatment option in extensive pulmonary embolism.

❑ ***Disadvantages:***

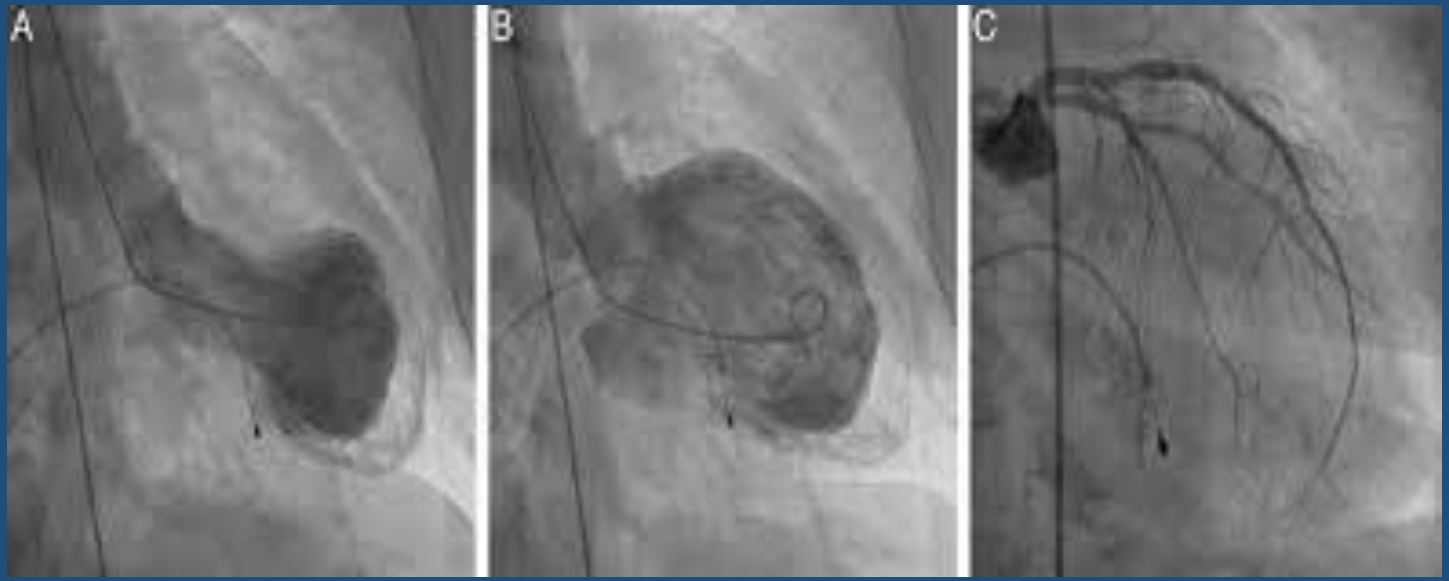
- ➢ Use Ionizing radiation.
- ➢ Invasive procedure.
- ➢ Contrast complications.

cardiac catheterization





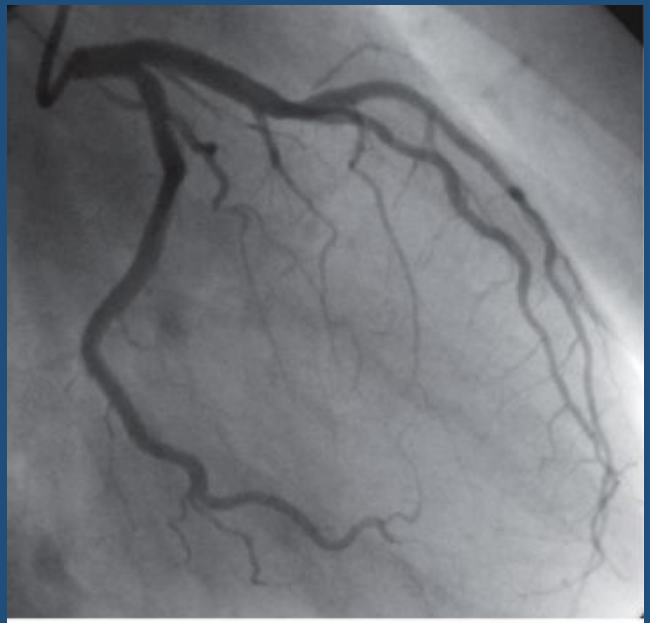
cardiac catheterization



Left ventricle

Coronary arteries

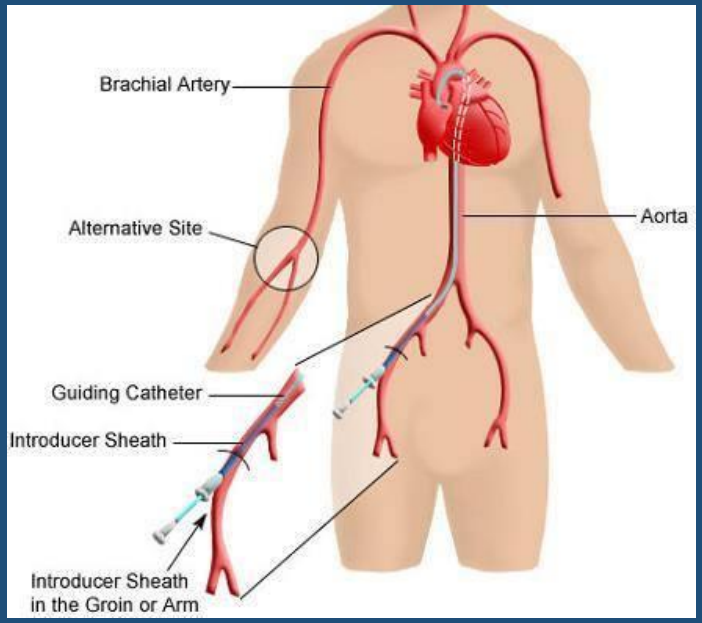
Normal coronary arteries

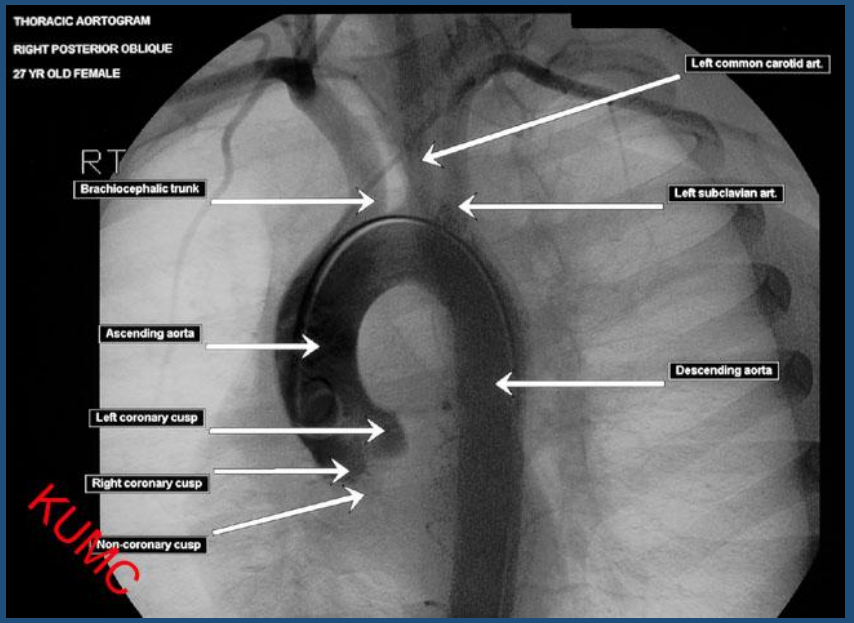


Normal coronary arteries on the left side of the heart

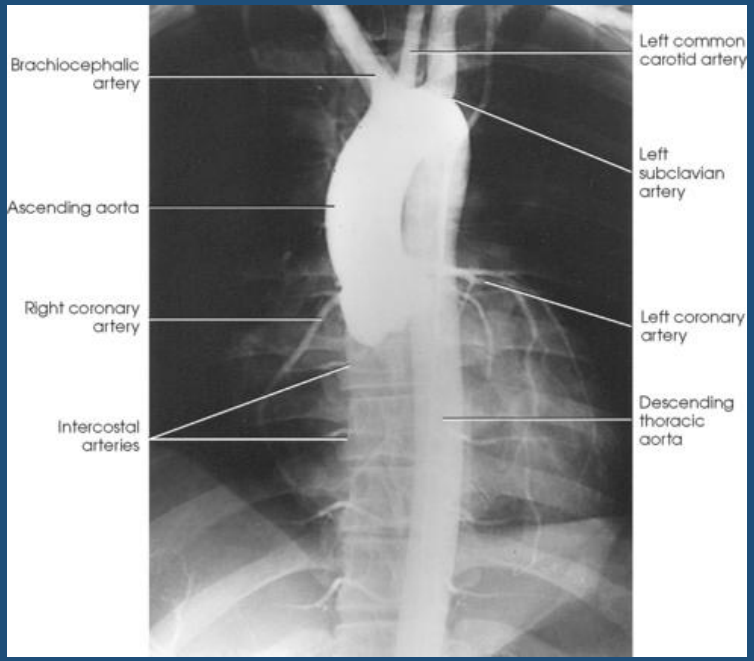
Normal coronary arteries on the right side

Aortogram

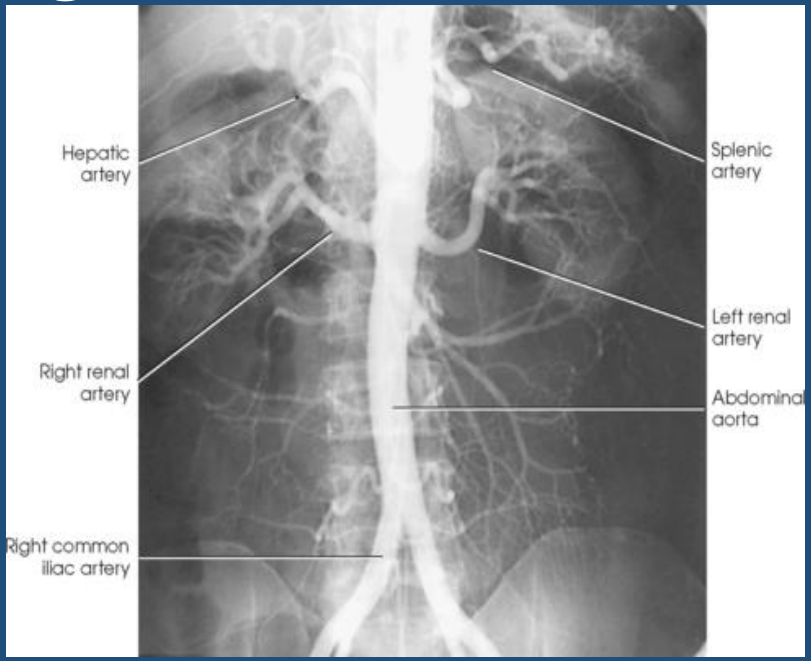

Brachial Artery
Alternative Site
Aorta
Guiding Catheter
Introducer Sheath
Introducer Sheath
in the Groin or Arm


THORACIC AORTOGRAM
RIGHT POSTERIOR OBLIQUE
27 YR OLD FEMALE
RT
Left common carotid art.
Brachiocephalic trunk
Left subclavian art.
Ascending aorta
Descending aorta
Left coronary cusp
Right coronary cusp
Non-coronary cusp
KUMC

Aortogram

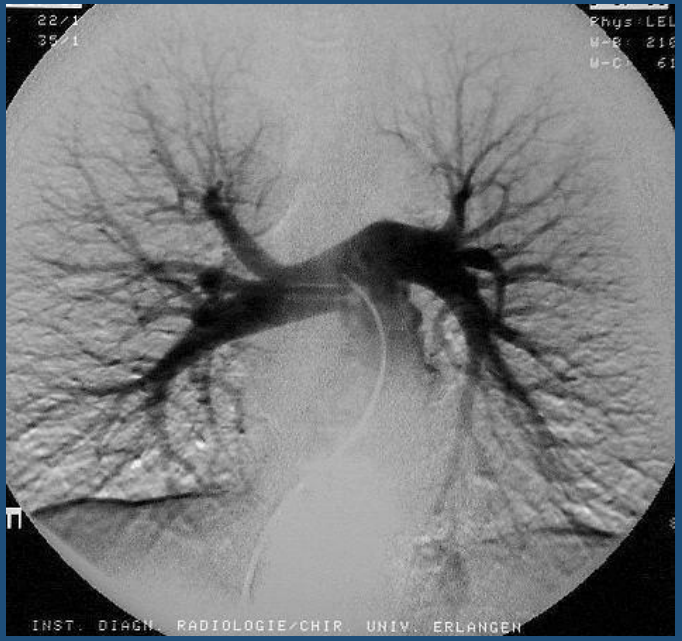


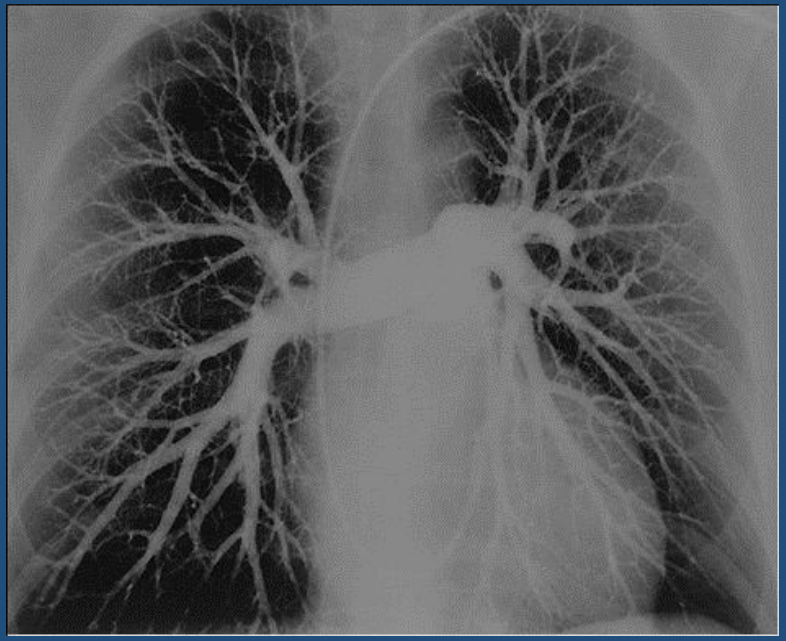
Thoracic aorta



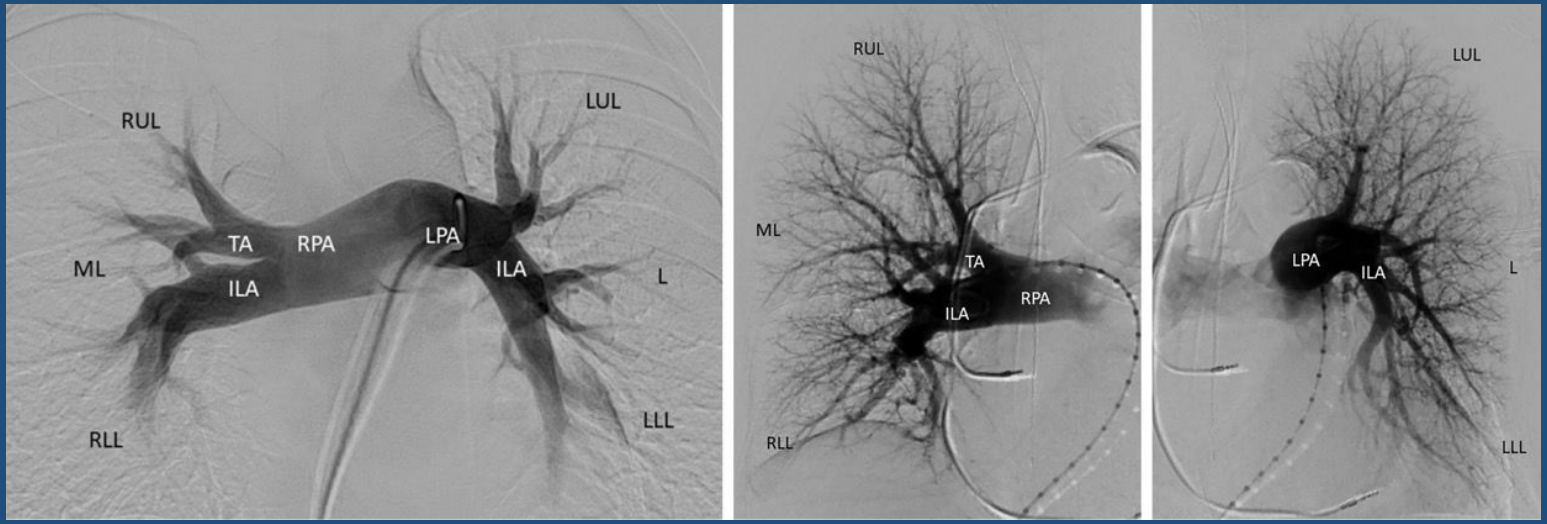
Abdominal

Pulmonary angiogram





Pulmonary angiogram



RPA = Right Pulmonary Artery; LPA = Left Pulmonary Artery; ILA = Interlobar Artery; TA =Truncus Anterior; RUL = Right Upper Lobe; ML = Middle Lobe; RLL = Right Lower Lobe ; LUL = Left Upper Lobe ; L = Lingual ; LLL = Left Lower Lobe.

CT scan

CT scan

CT scan

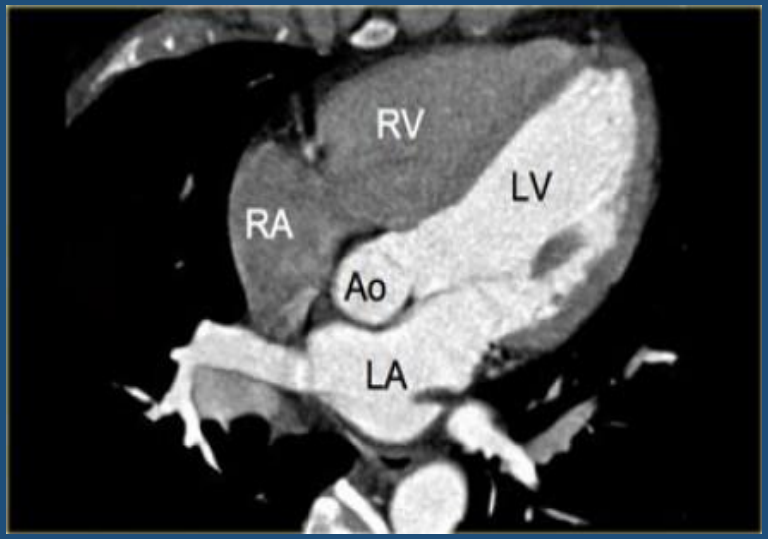
❑*Advantages :*

- ➢ Widely available, relative cheap.
- ➢ Proper in assessing pulmonary artery and aorta.
- ➢ Proper in assessing coronary arteries (e.g. stenosis, calcification).
- ➢ Proper in assessing heart anatomy.
- ➢ Proper in assessing structure around the heart and mediastinal vessels (e.g. lungs).

❑*Disadvantages:*

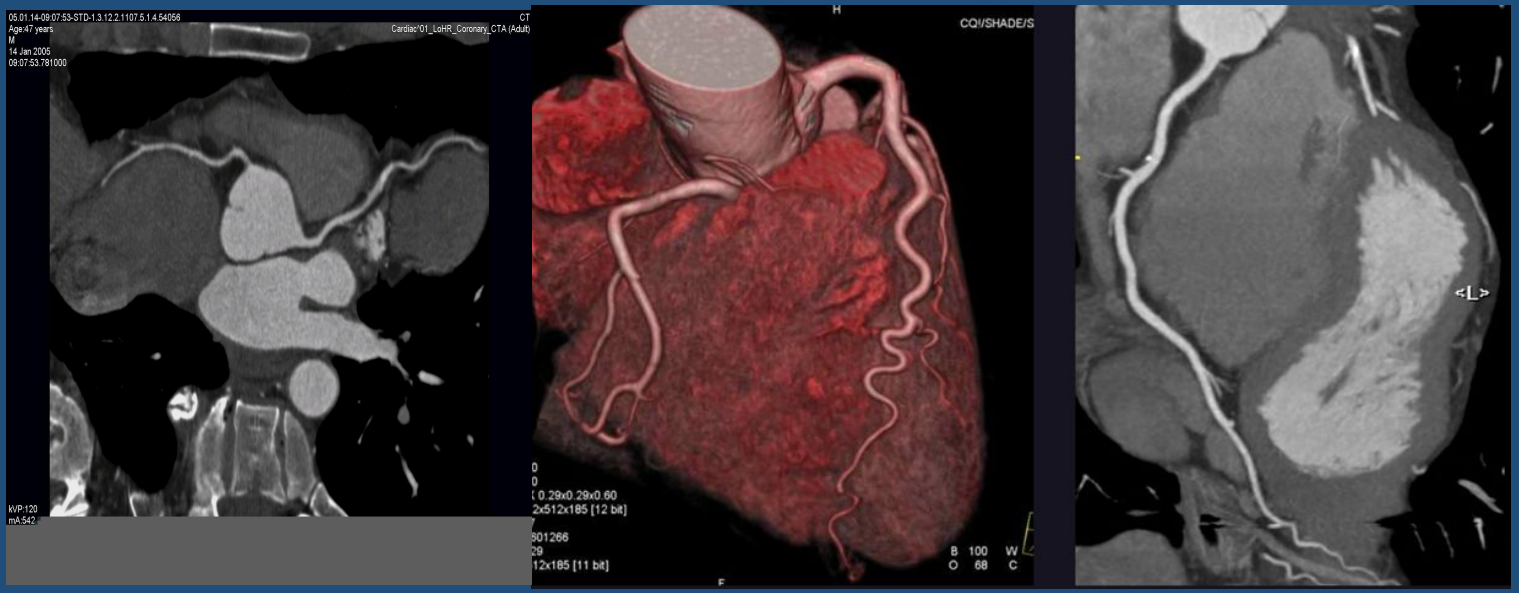
- ➢ Use Ionizing radiation.
- ➢ Heart rate < 60 beat/min for an adequate cardiac exam.
- ➢ Intravenous contrast complications.

Cardiac CT



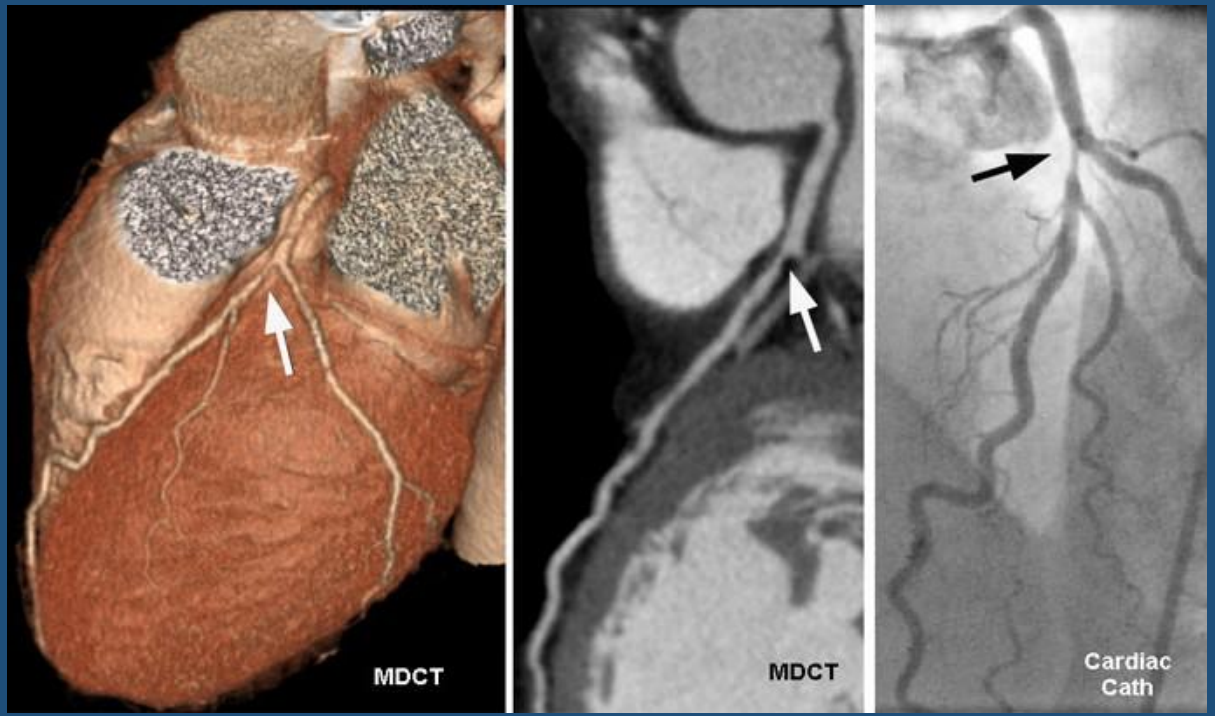
Cardiac chambers

Cardiac CT



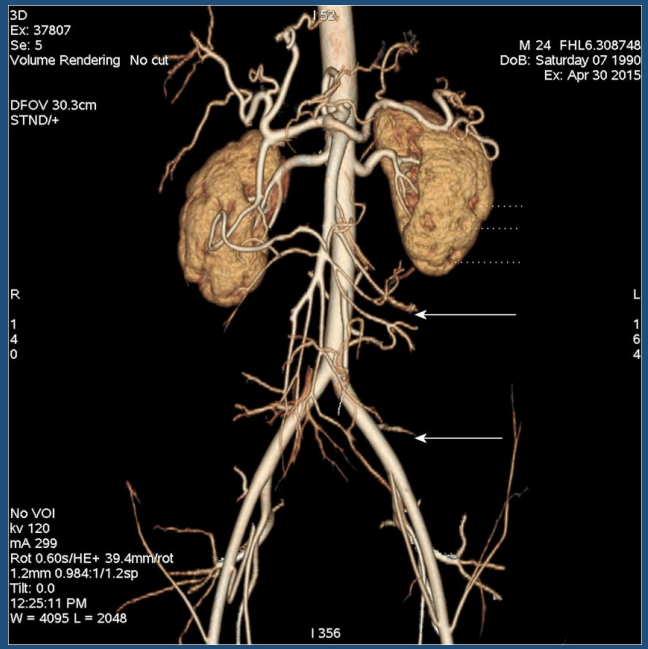
Coronary arteries

Cardiac CT vs cardiac cath.



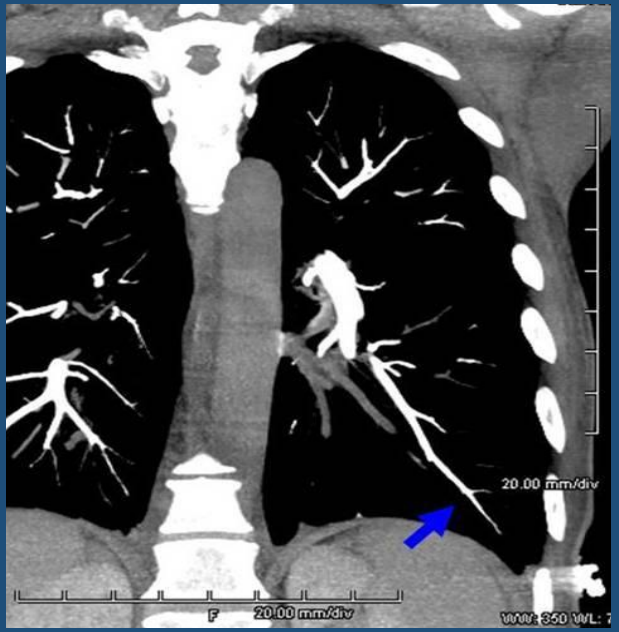
CT aortogram

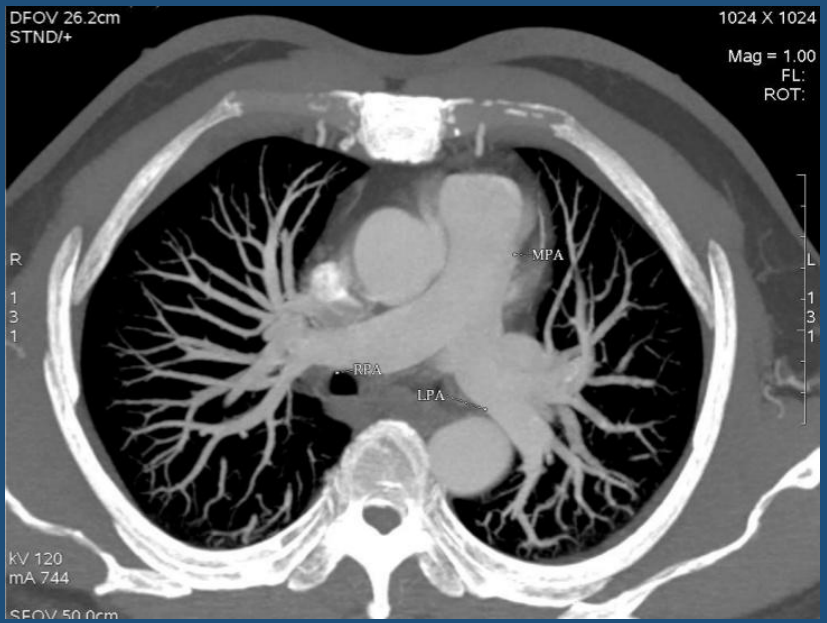
CT aortogram



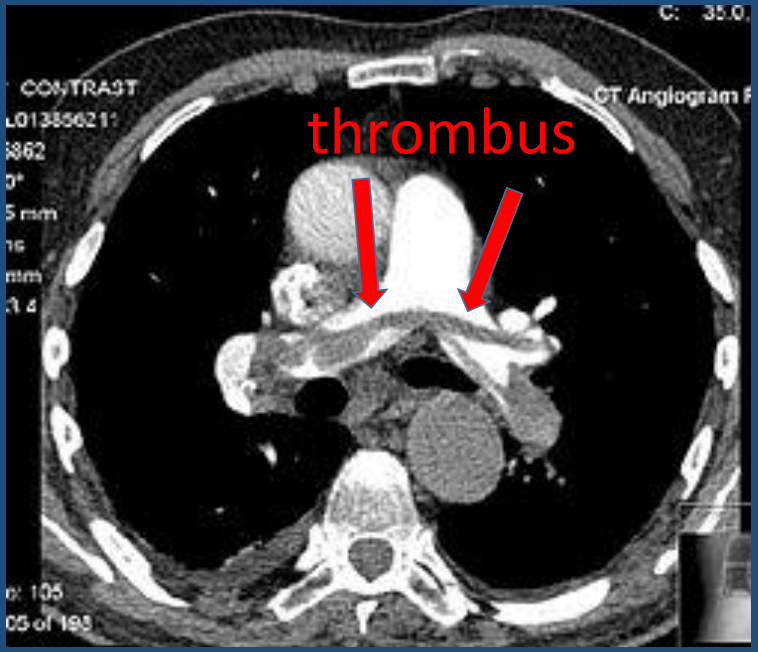
Volume rendering

CT Pulmonary angiogram





CT Pulmonary angiogram



Gold standard exam to diagnose Pulmonary Embolism

MRI

MRI

MRI

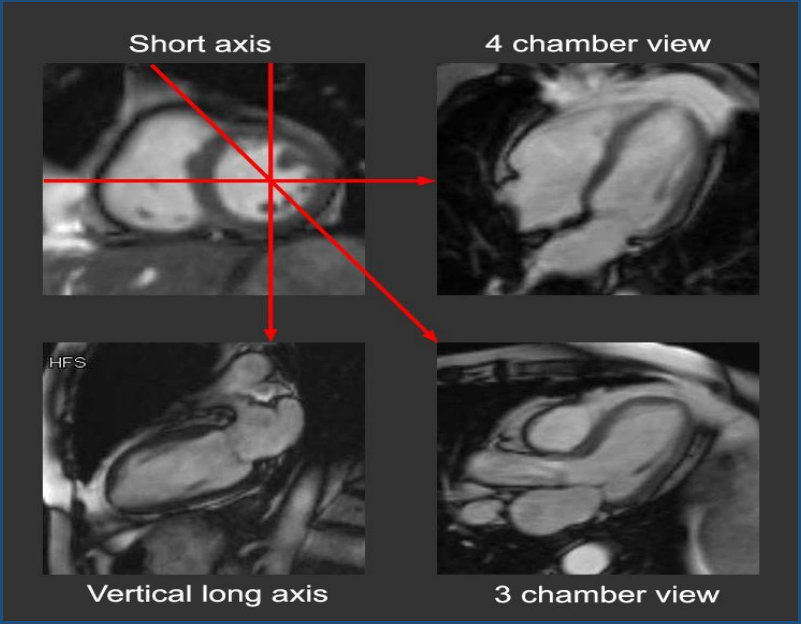
❑ ***Advantages :***

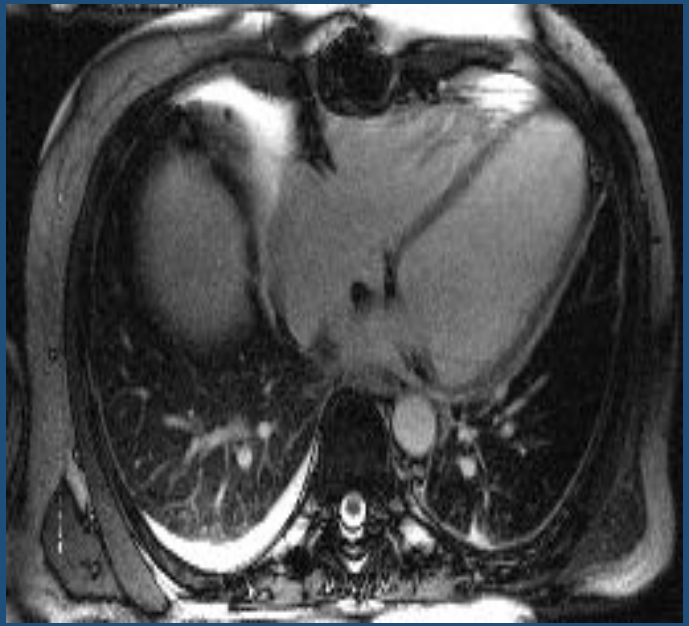
- ➢ No Ionizing radiation.
- ➢ Better soft tissue Characterization.
- ➢ Proper in assessing myocardium (e.g. infarction, infiltrative diseases).
- ➢ Proper in assessing cardiac valves.
- ➢ Proper in assessing aorta.

❑ ***Disadvantages:***

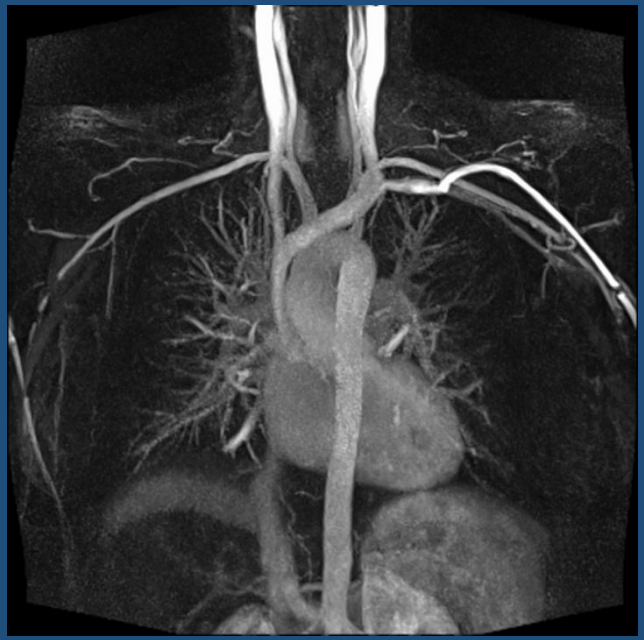
- ➢ Not widely available.
- ➢ Contra indications (cardiac devices)
- ➢ Intravenous contrast complications.

Cardiac MRI

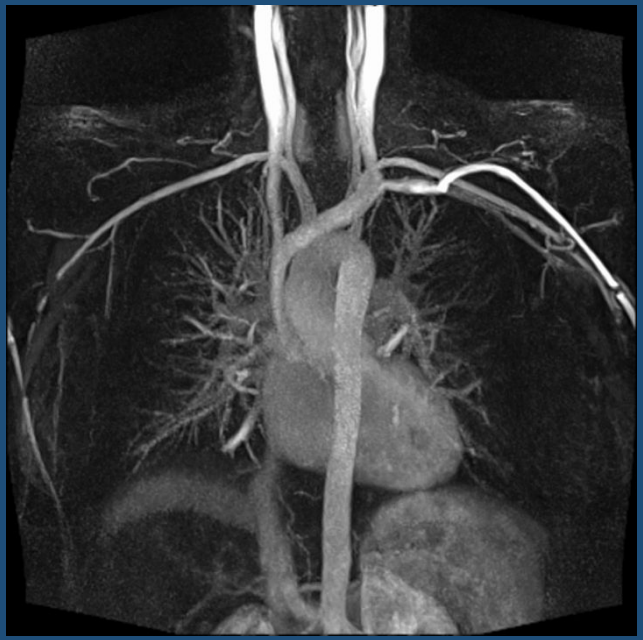

Short axis
4 chamber view
HFS
Vertical long axis
3 chamber view



MRI Aortogram



MRI vs CT



Nuclear scan

Nuclear scan

Nuclear scan

❑ ***Advantages:***

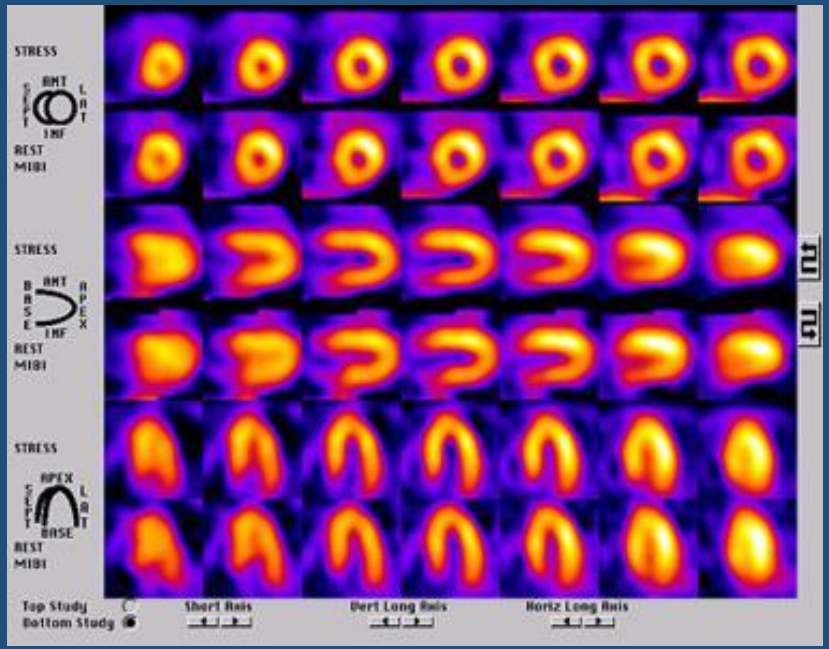
- ➢ Assess physiology/ pathophysiology
- ➢ Proper in assessing myocardium perfusion (e.g. ischemia vs infarction).
- ➢ Proper in assessing lung perfusion (pulmonary embolism) alternative to CT scan.

❑ ***Disadvantages:***

- ➢ Use ionizing radiation.
- ➢ Not widely available.
- ➢ Poor in assessing anatomy.

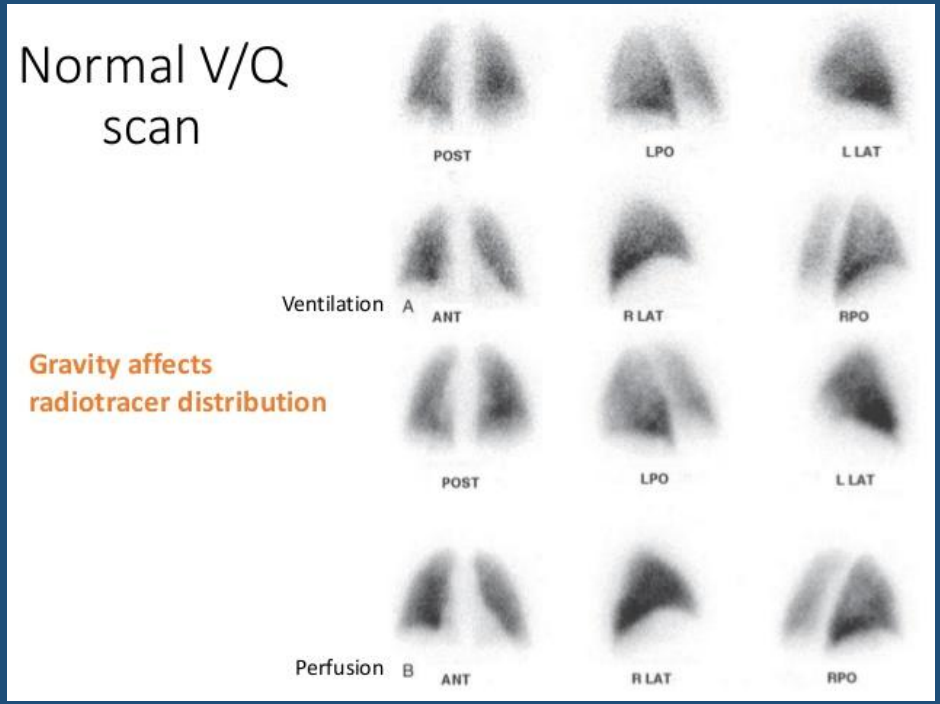
Cardiac scan

- A study to assess myocardial perfusion (mainly left ventricle).
- Includes a stress and rest phases.
- Normal exam shows continuous uptake of left ventricle (no defects).



V/Q scan

- A study to diagnose pulmonary embolism.
- Alternative to CT scan.
- Includes ventilation phase and perfusion phase.
- Normal exam shows similar lungs uptake in ventilation and perfusion phases.



Thank you