

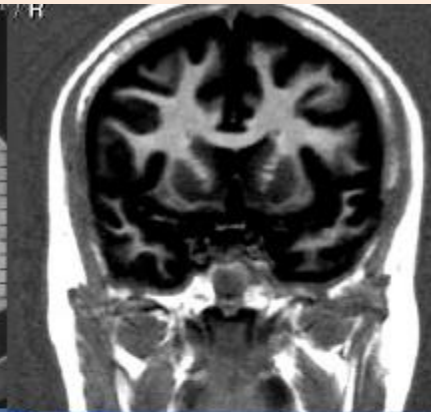
# Imaging modalities in medicine



Radiography



CT

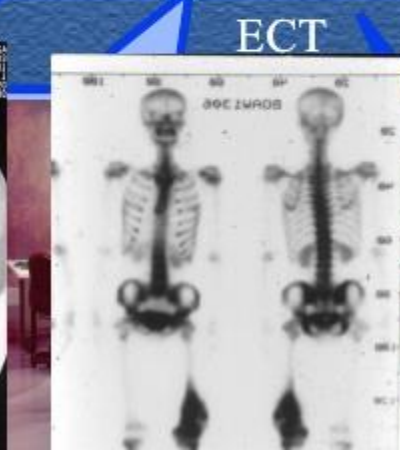


MRI

## Technology of Radiology



DSA



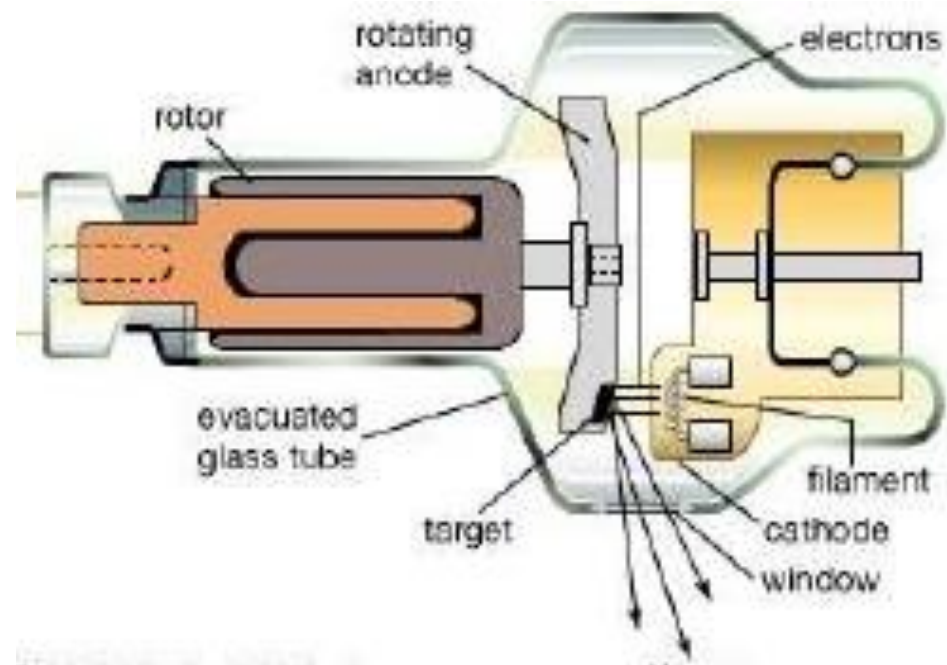
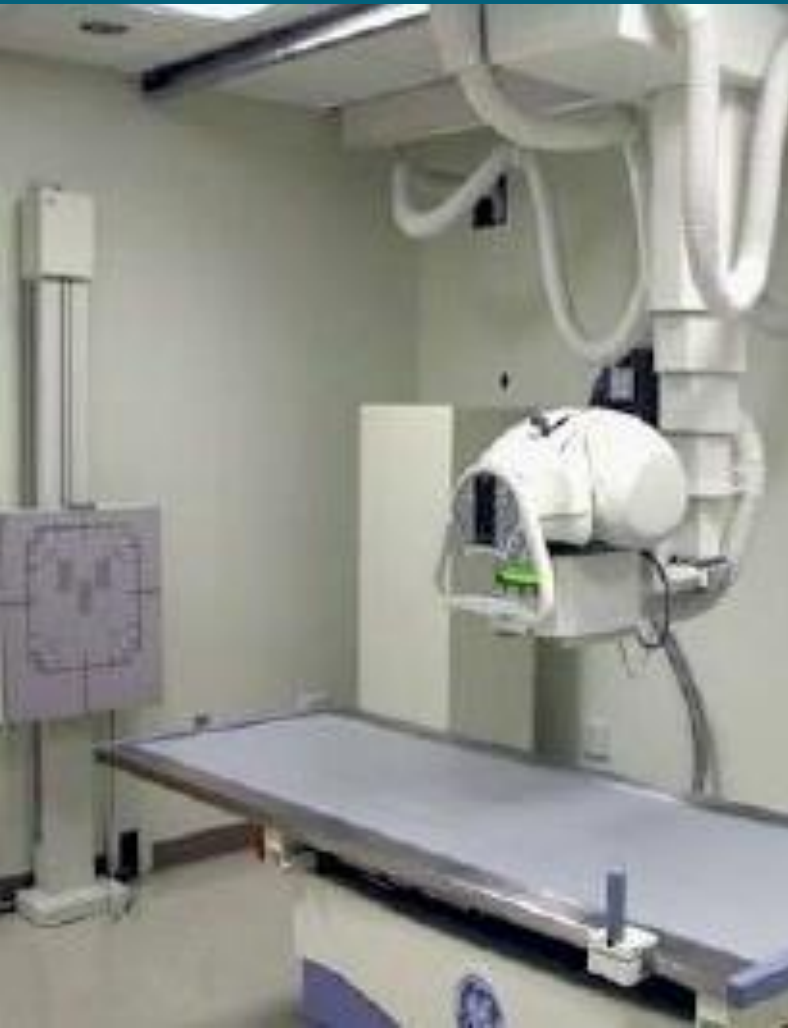
ECT



Ultrasound



# Conventional Radiography







# Conventional Radiography

## PRINCIPLES OF IMAGE INTERPRETATION

- Structures are seen when outlined by tissues of different xray attenuation



# Conventional Radiography

## PRINCIPLES OF INTERPRETATION

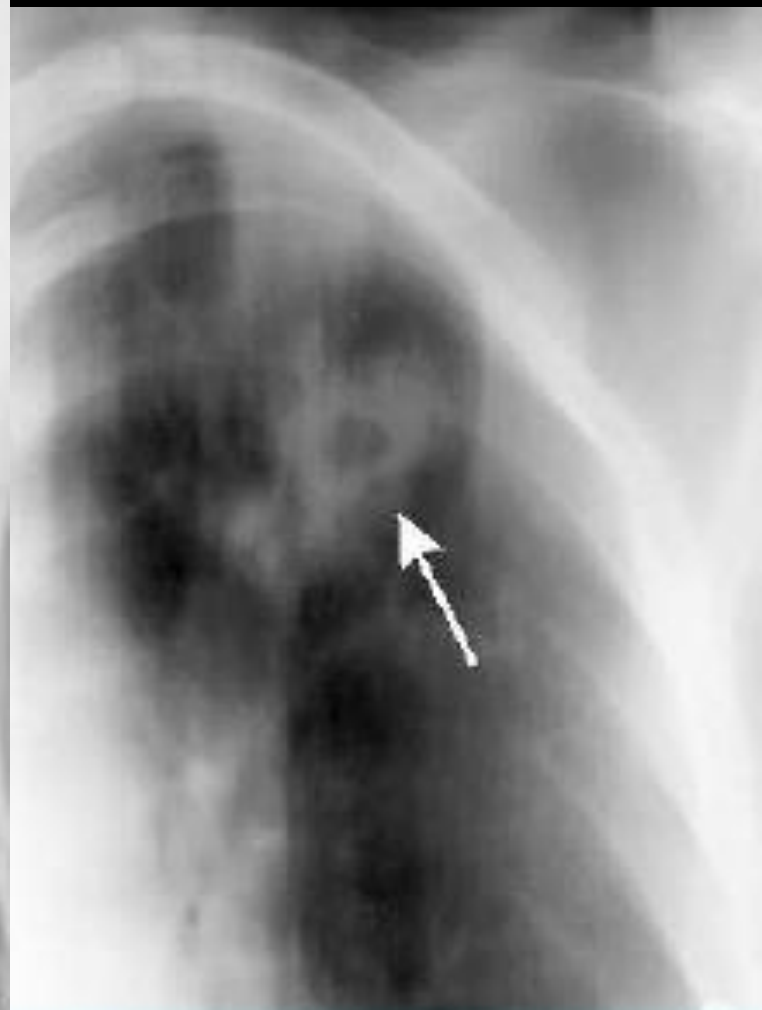
- 5 basic radiographic densities:
  - Air – little attenuation
  - Fat – intermediate attenuation
  - Soft tissue – intermediate attenuation
  - Bone – high attenuation
  - Metal/Contrast agents – high attenuation

# Conventional Radiography





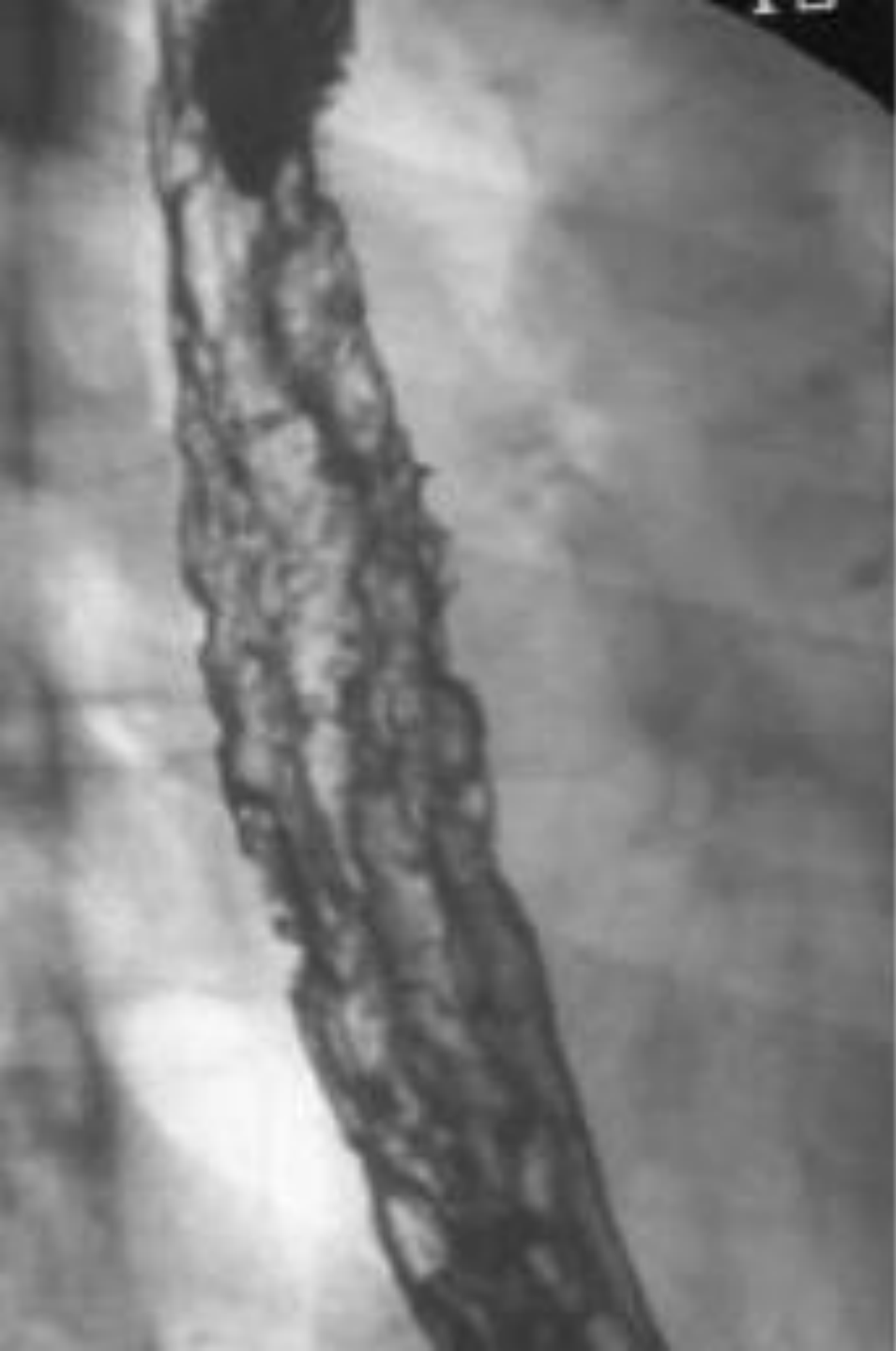
# CONVENTIONAL TOMOGRAPHY





# FLUOROSCOPY

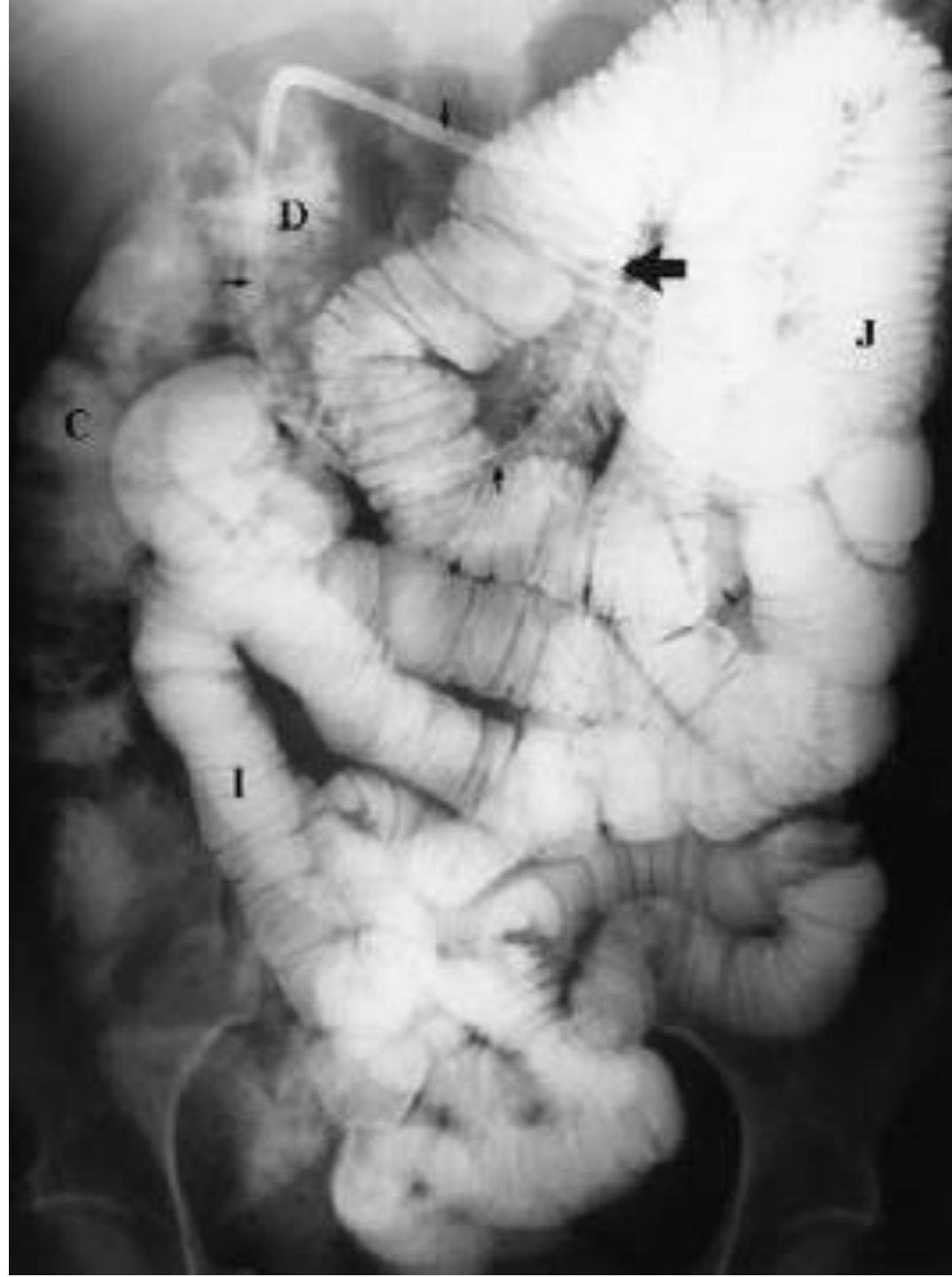






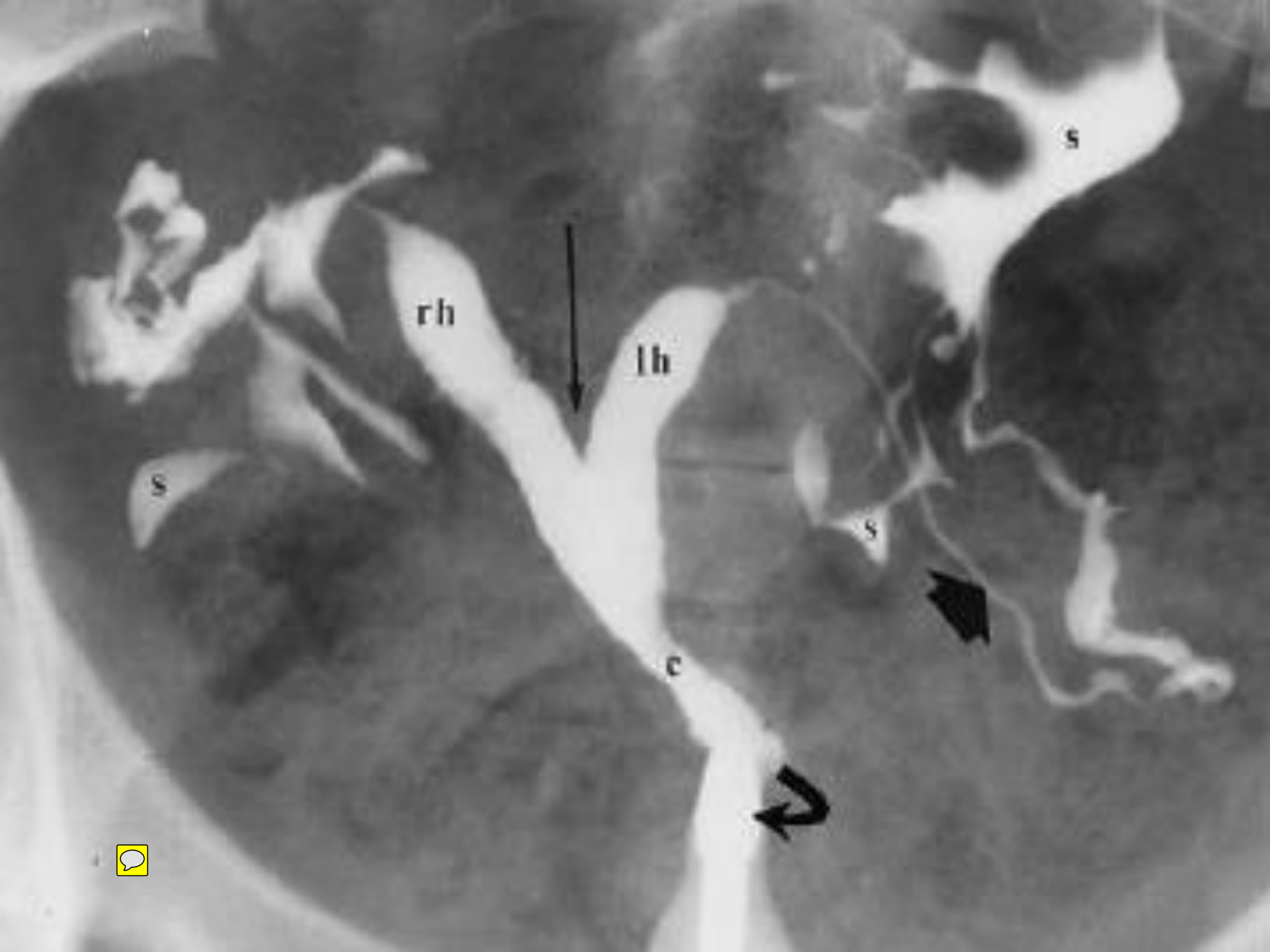












rh

lh

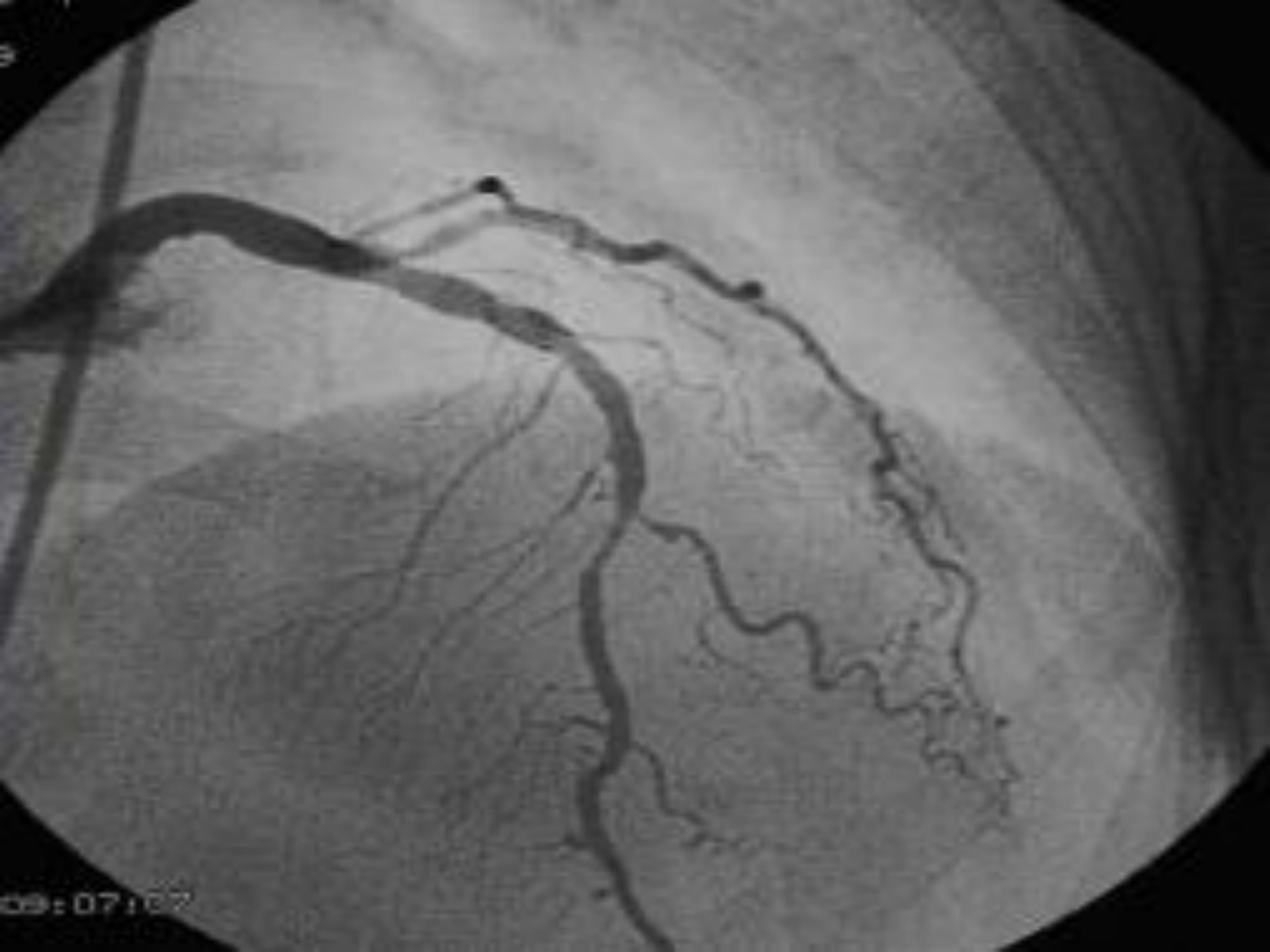
s

s

s

c





09:07:07



0:24:10  
0.48

H



COMPUTED

RADIOGRAPHY



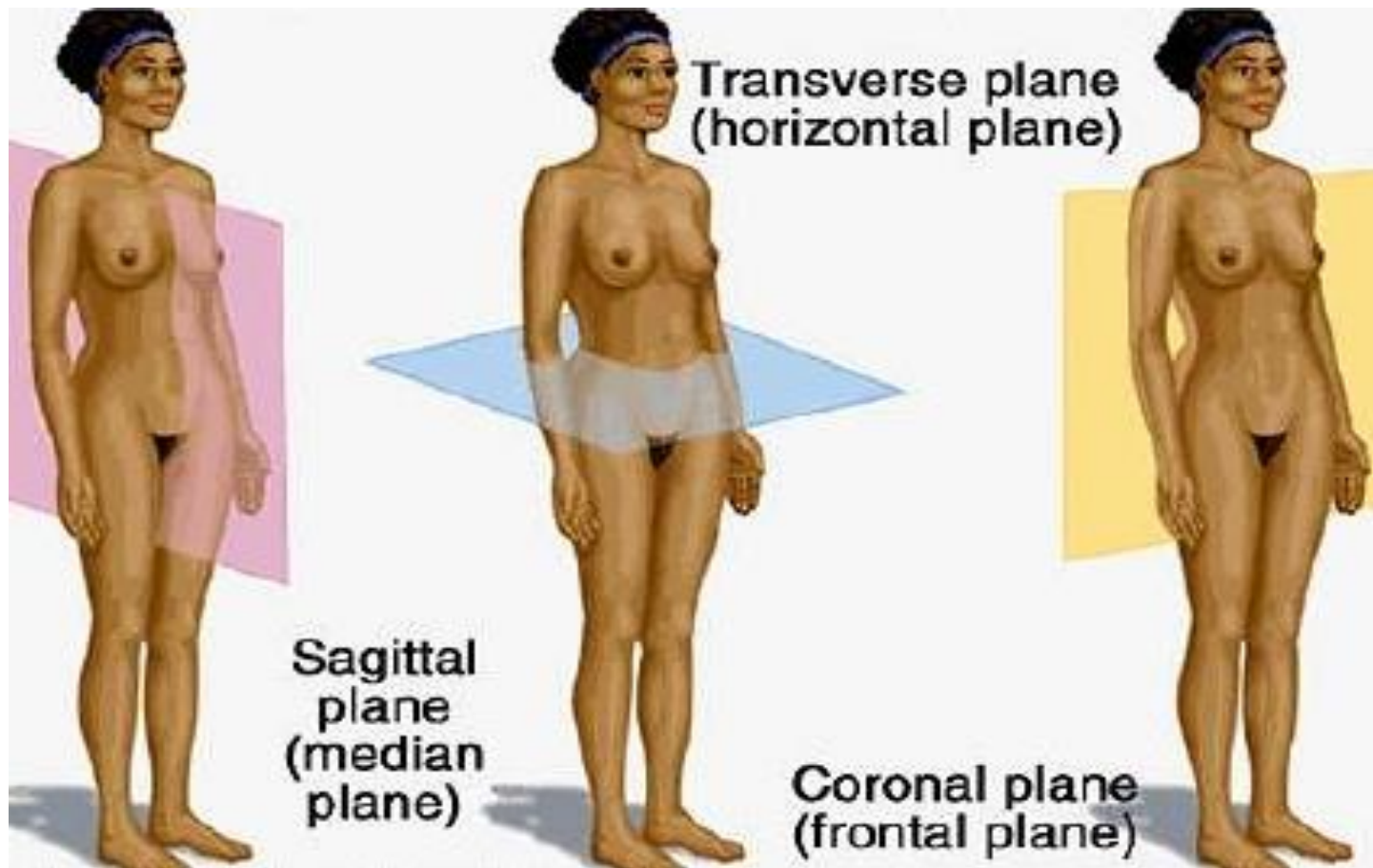






# CROSS-SECTIONAL IMAGING

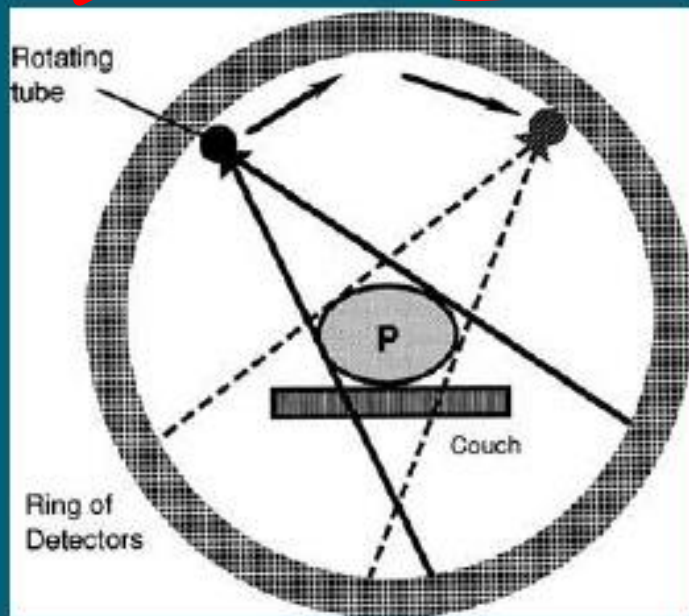
## IMAGING PLANES



# CROSS-SECTIONAL IMAGING

## COMPUTED TOMOGRAPHY

- Computer reconstruction of cross section of body from measurements of x-ray transmission through thin slices of the patient



# CROSS-SECTIONAL IMAGING

## COMPUTED TOMOGRAPHY

- Conventional CT
  - Images obtained one slice at a time
- Helical/Spiral CT
  - Patient table moves while xray tube rotates around patient
- Multidetector helical CT
  - Multiple detectors allowing multiple slices per rotation of the xray tube



# CROSS-SECTIONAL IMAGING

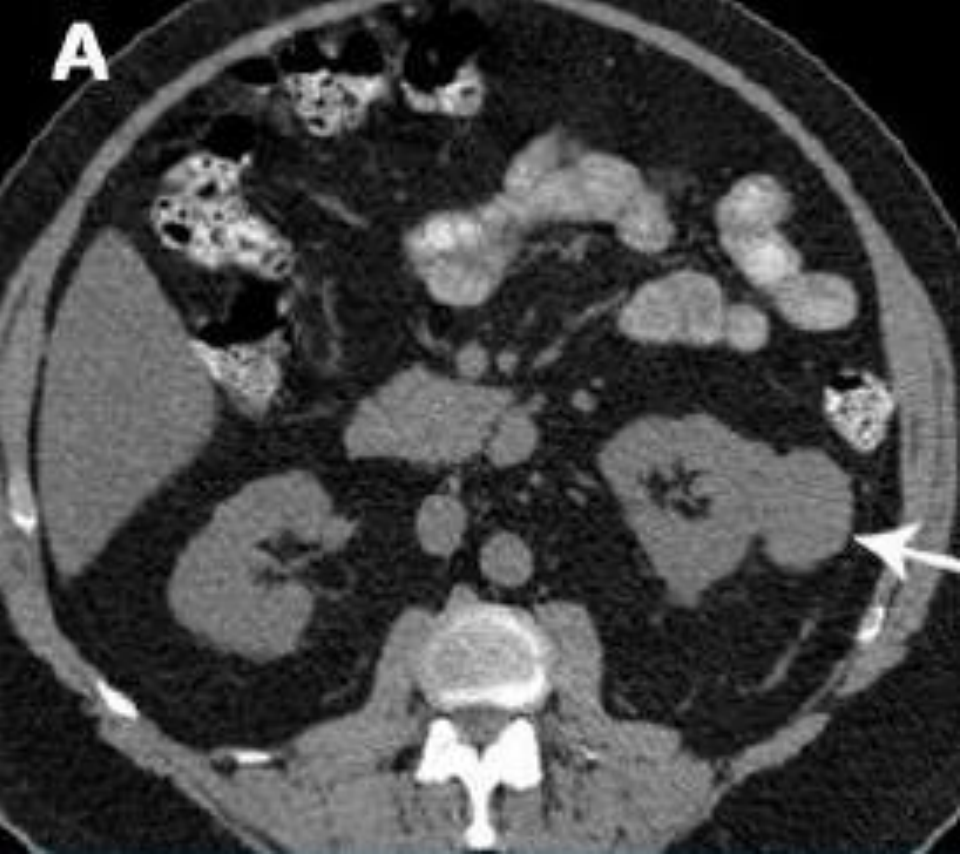
## COMPUTED TOMOGRAPHY

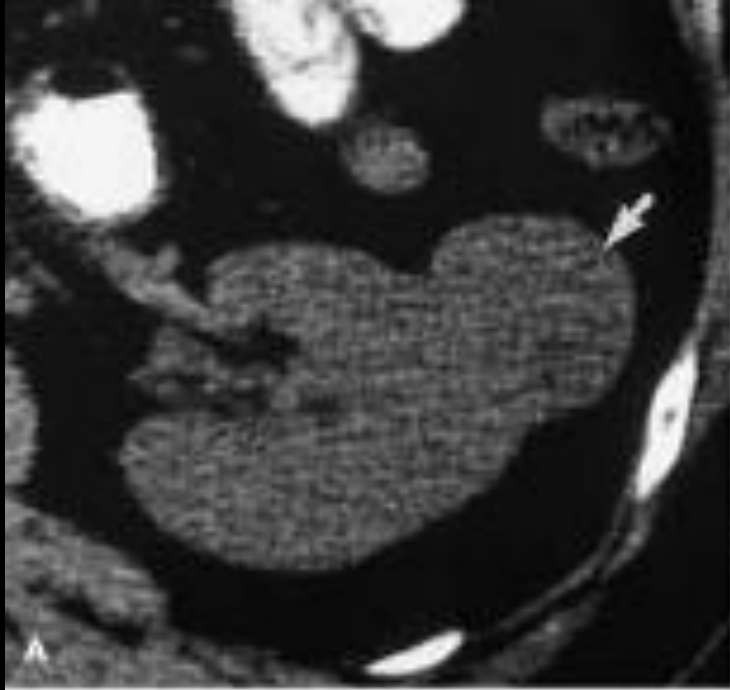
### Contrast:

- Intravenous – Enhance density differences between lesions and surrounding parenchyma, demonstrate vascular anatomy, and characterize lesions by patterns of contrast enhancement
- Oral – Required to opacify the bowel to help differentiate between tumors, lymph nodes, and hematomas

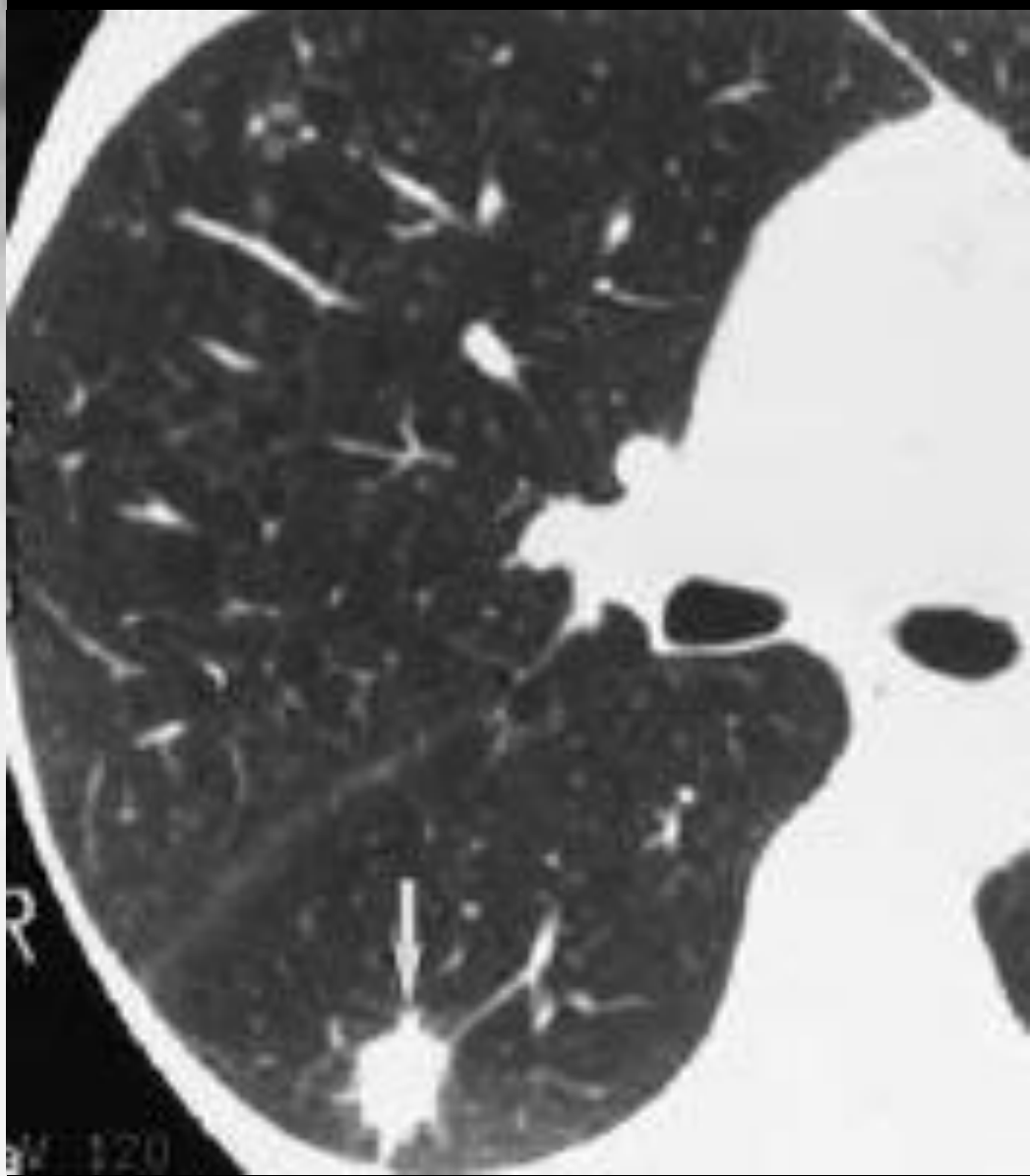




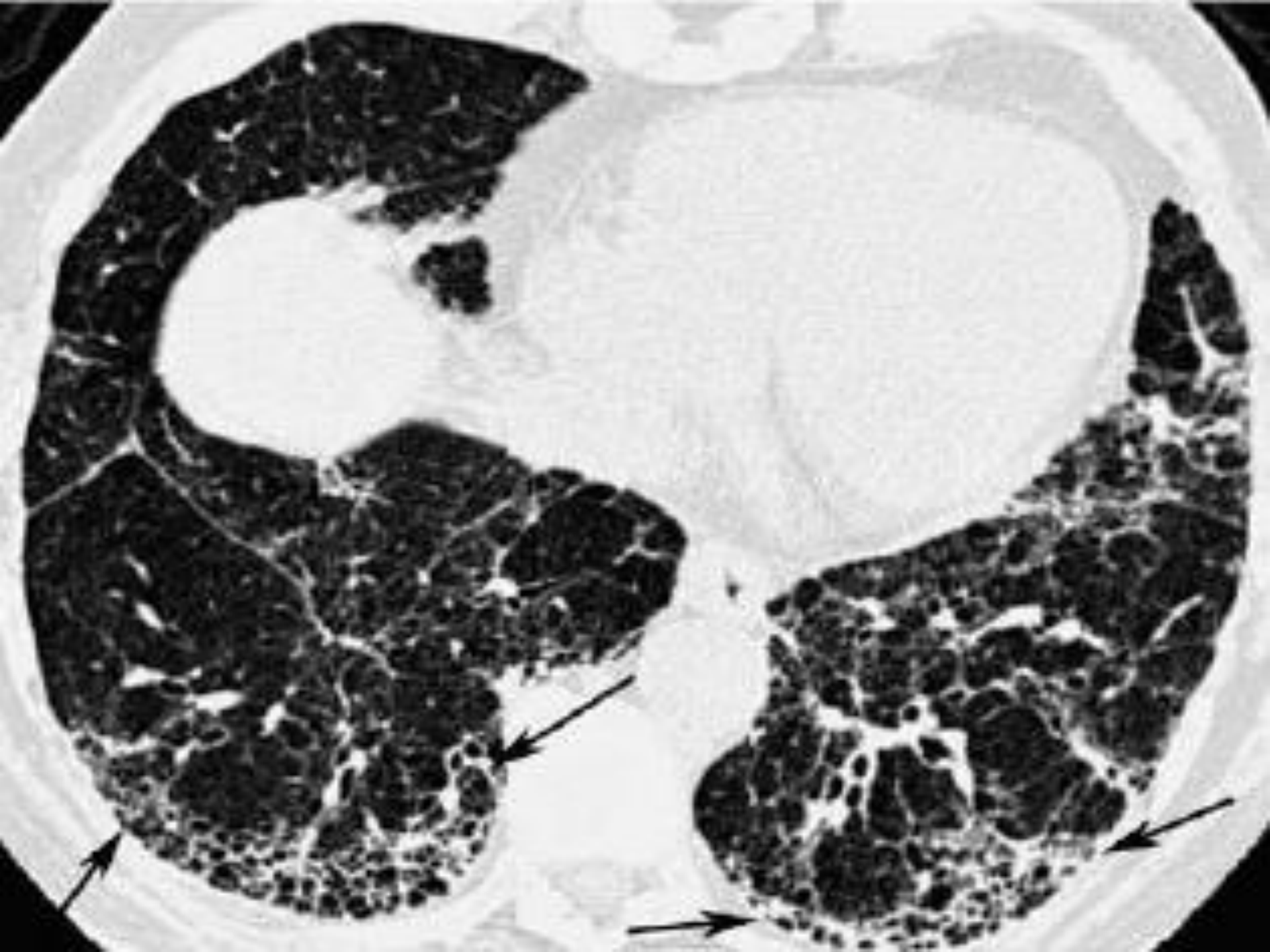




**Triphasic CT**



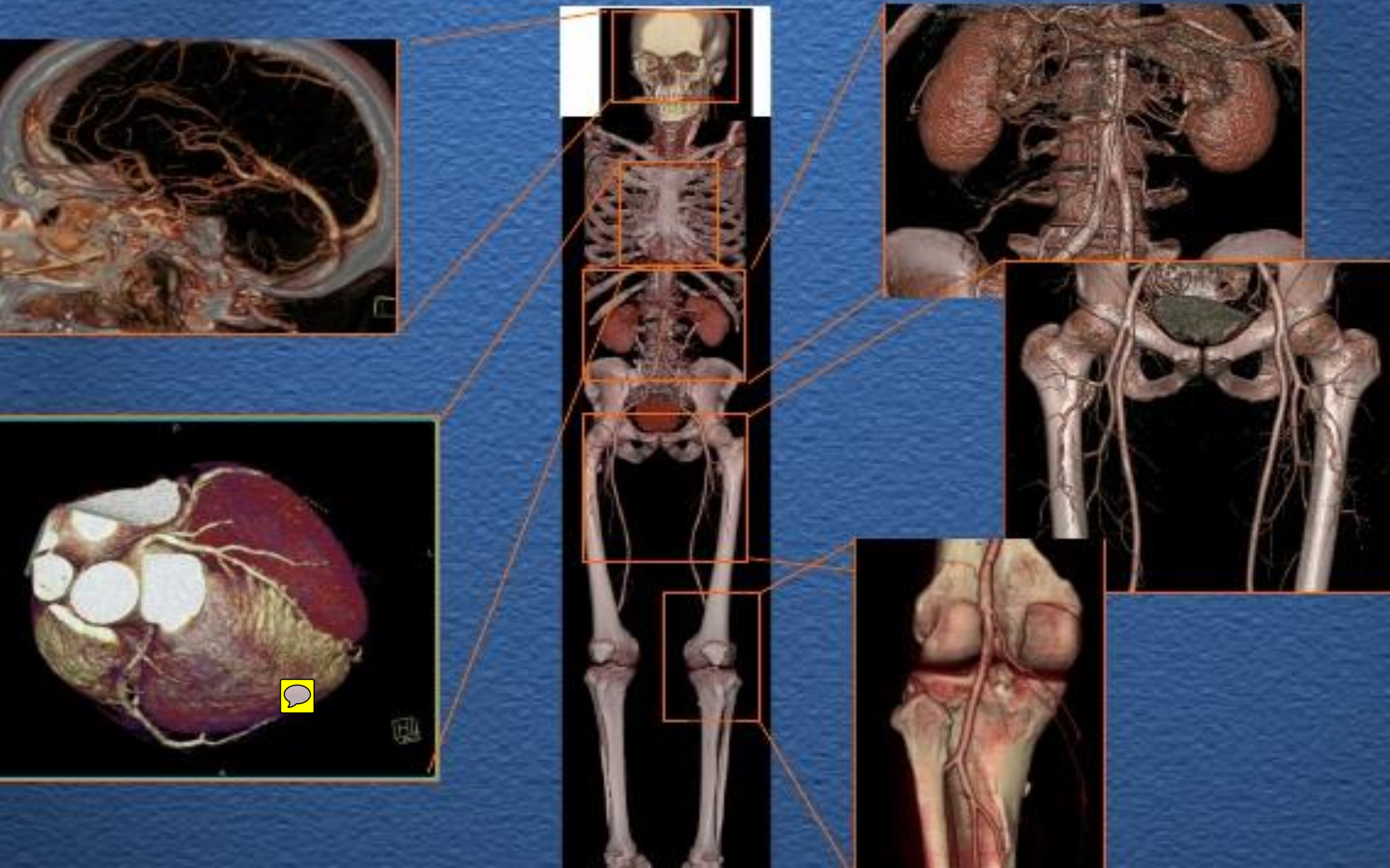








# 64 MDCT/MSCT







FRA



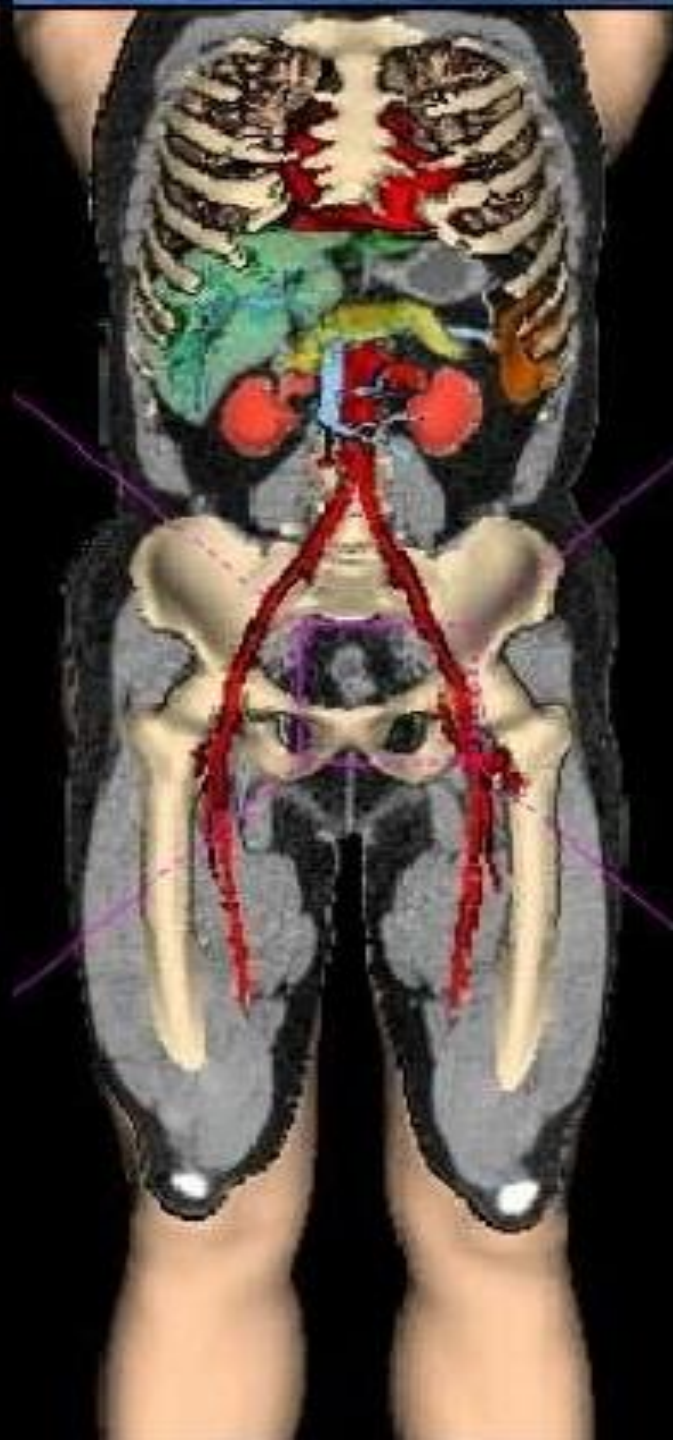
F



FIA



F





# Multislice CT





# Normal coronary artery CT reconstruction

on 64

mm

degrees

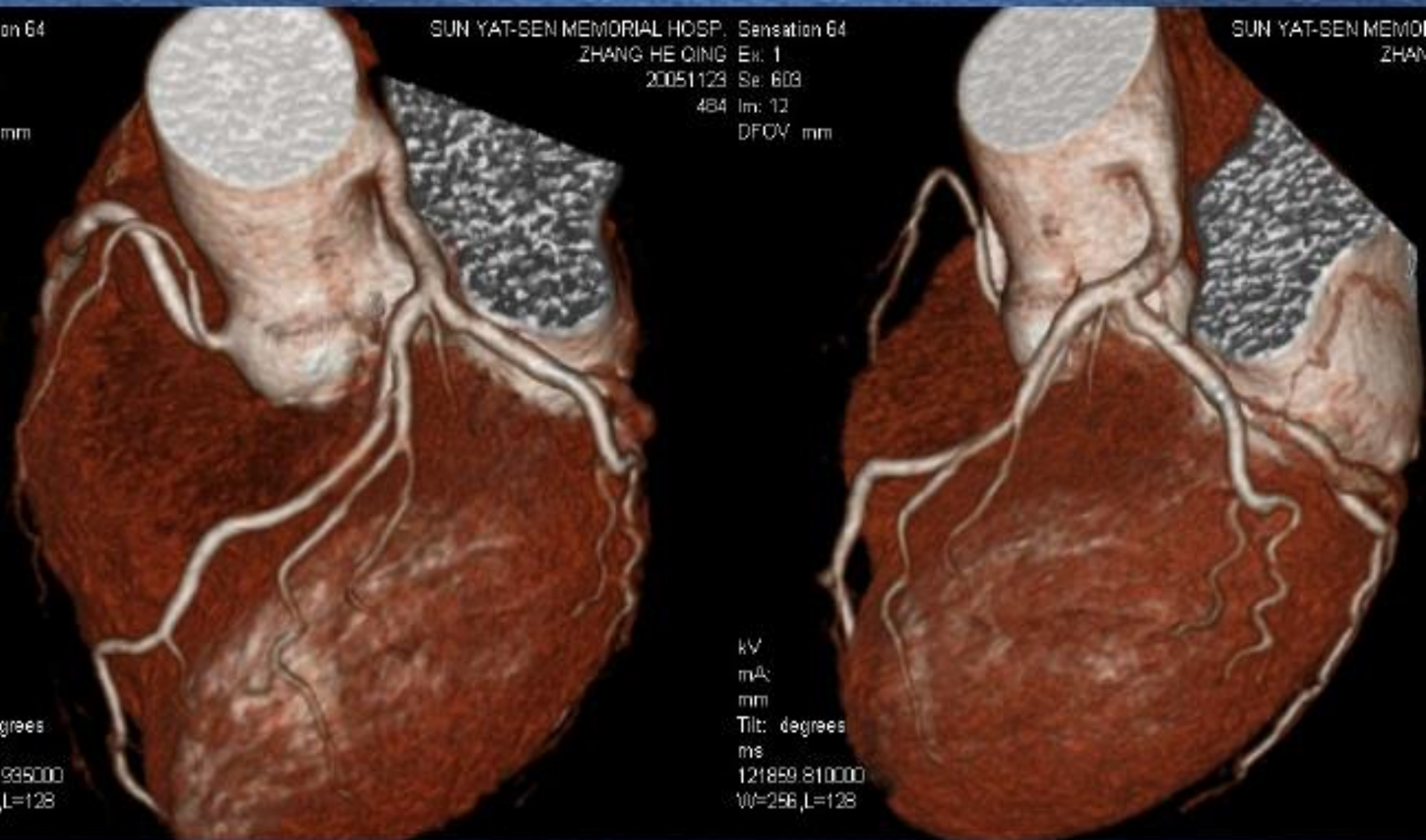
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L=128

SUN YAT-SEN MEMORIAL HOSP. Sensation 64  
ZHANG HE QING Ek: 1  
20051123 Se: 608  
484 Im: 12  
DFOV mm

kV  
mA  
mm  
Tilt: degrees  
ms  
121859 810000  
W=256,L=128

SUN YAT-SEN MEMORIAL HOSP.  
ZHANG HE QING



# CROSS-SECTIONAL IMAGING

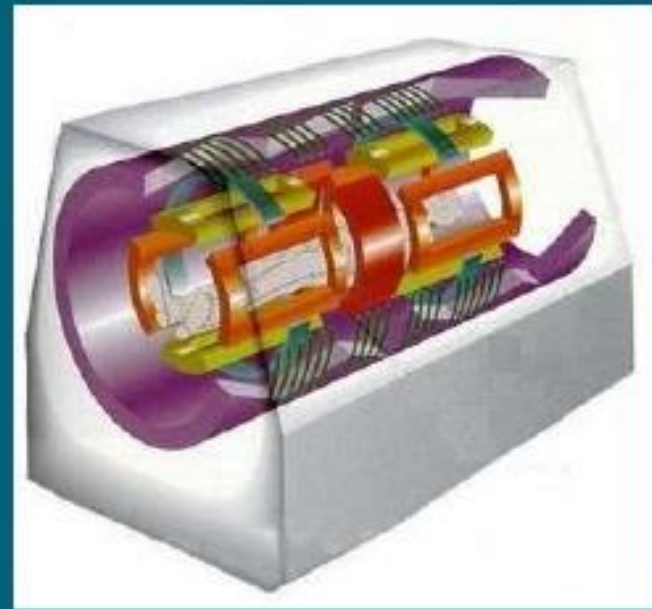
## MAGNETIC RESONANCE IMAGING

- Based on the ability of protons in the body to absorb and emit radio wave energy when the body is placed in a strong magnetic field
- Multiple different pulse sequences used to emphasize different tissue characteristics
- Advantages: excellent soft tissue contrast resolution, provides images in any plane, absence of ionizing radiation
- Limitations: Inability to demonstrate dense bone detail or calcifications, long imaging times, limited spatial resolution compared with CT, expensive

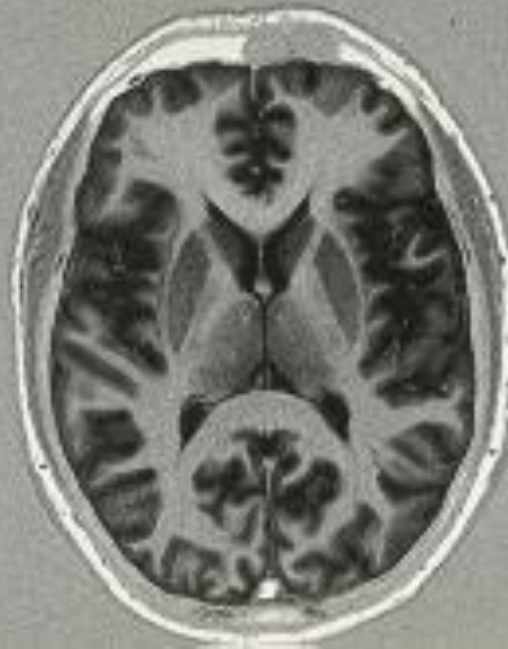


# CROSS-SECTIONAL IMAGING

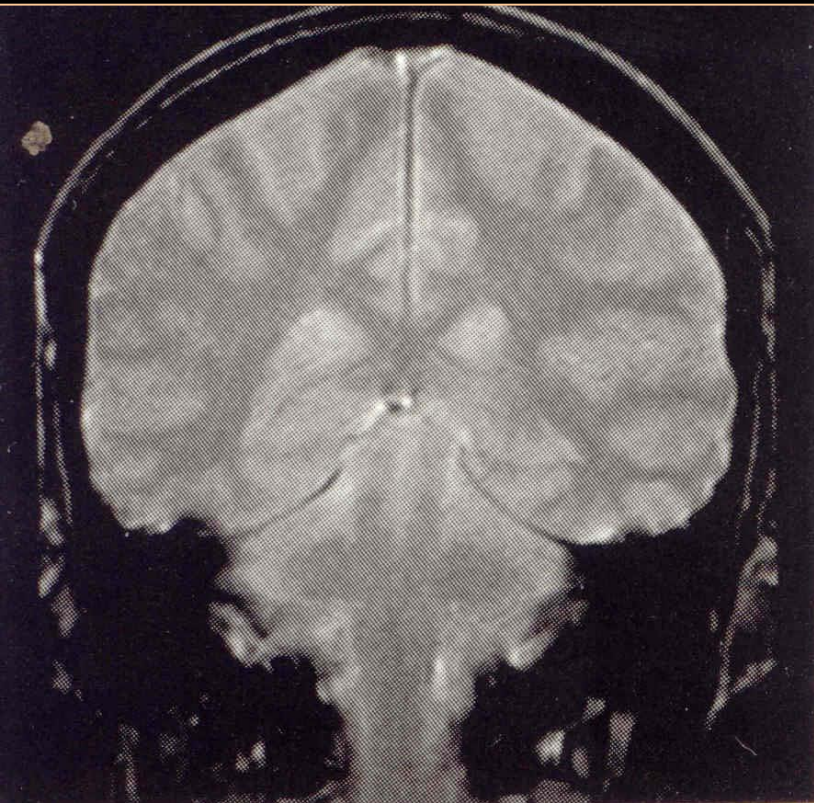
## MAGNETIC RESONANCE IMAGING



# Sequences at MR can vary

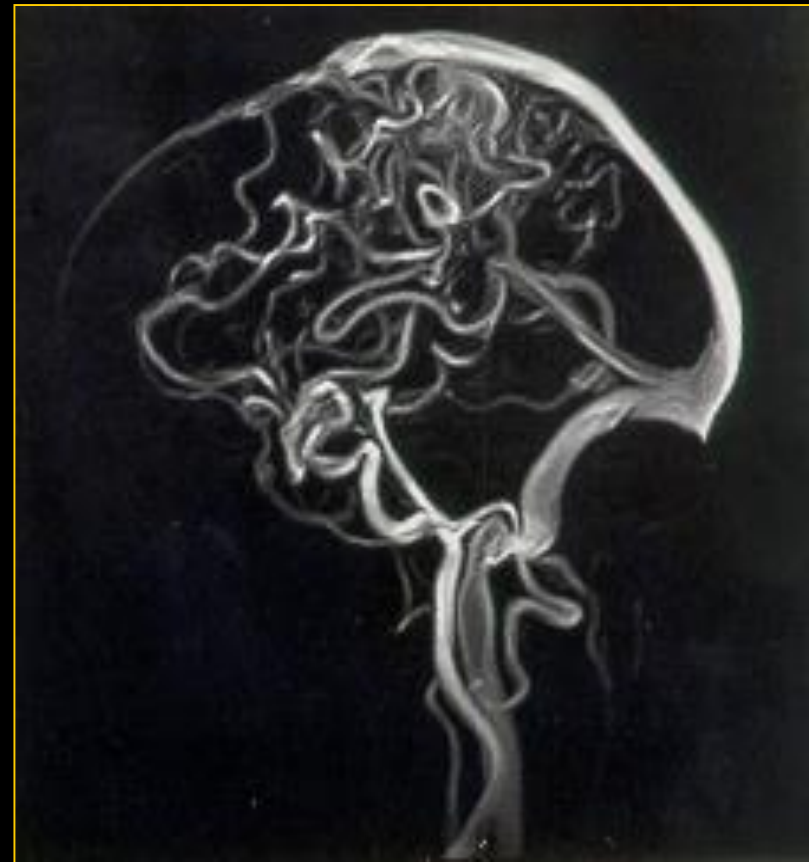
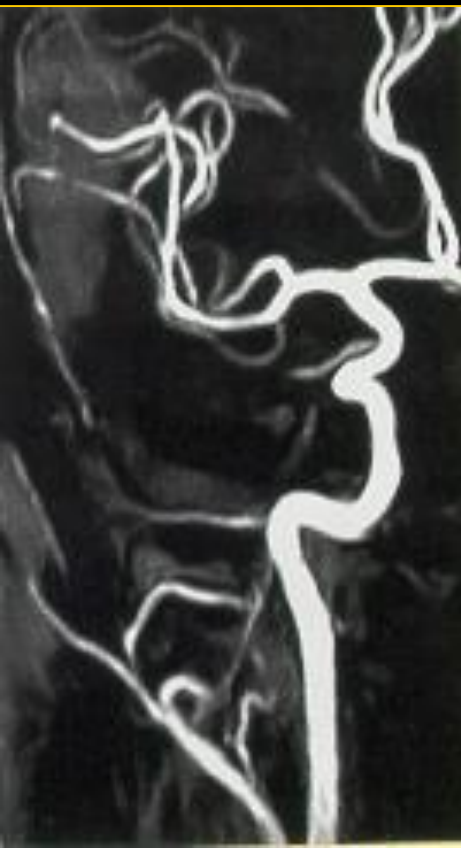


**Imaging planes are infinite**

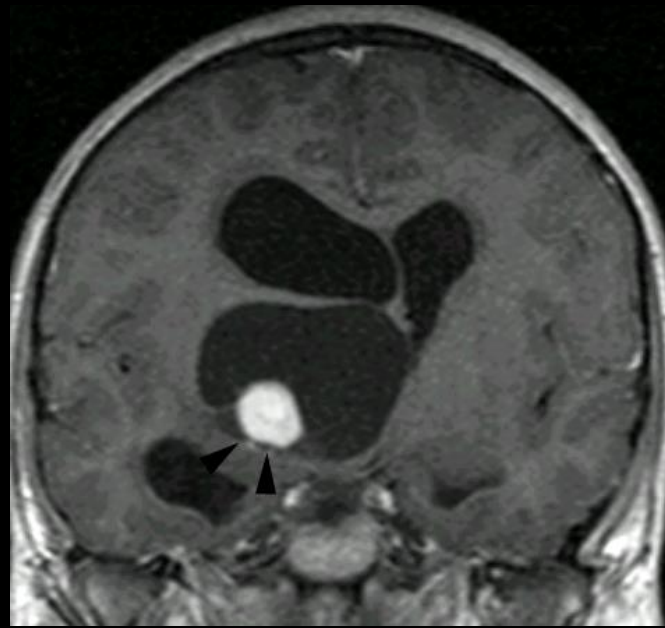




# Can see vessels without intravascular contrast agents



# PILOCYTIC ASTRO.



■ CECT

T1Gd

T2WI

■ 19YM. Pilocytic astro right basal ganglia

# Favored sites of JPA

- ❖ 60% are seen in the **posterior fossa**.
- ❖ The typical cerebellar astrocytoma in the pediatric age group is **cystic** in 60-80% of cases.
- ❖ Chiasmatic hypothalamic astrocytomas may present with the **diencephalic syndrome** characterized by **weight loss, motor hyperactivity and euphoria**.
- ❖ Talk of tots sucking on blow pops with a sugar buzz.



# CROSS-SECTIONAL IMAGING

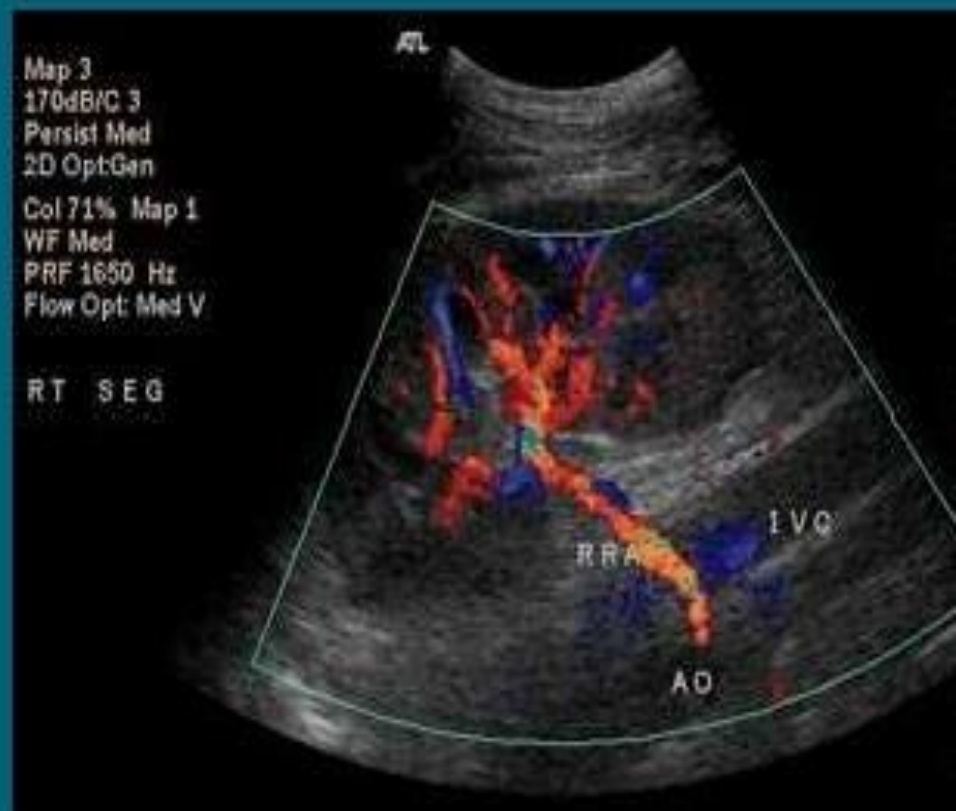
## ULTRASONOGRAPHY

- Ultrasound transducer converts electrical energy to a pulse of high frequency sound energy, which reflects off of tissues, producing echoes which are used to generate images.
- Real time imaging of moving patient tissue
- Doppler ultrasound permits detection of blood velocity and direction
- Highly operator dependent



# CROSS-SECTIONAL IMAGING

## ULTRASONOGRAPHY





ALPHAS INTERNATIONAL HOSPITAL

ABDOMEN1

17:24:16

1.4cm

1.4cm

37-6.0

C37-4.2

20Hz

20Hz

27



GE  
L7



11

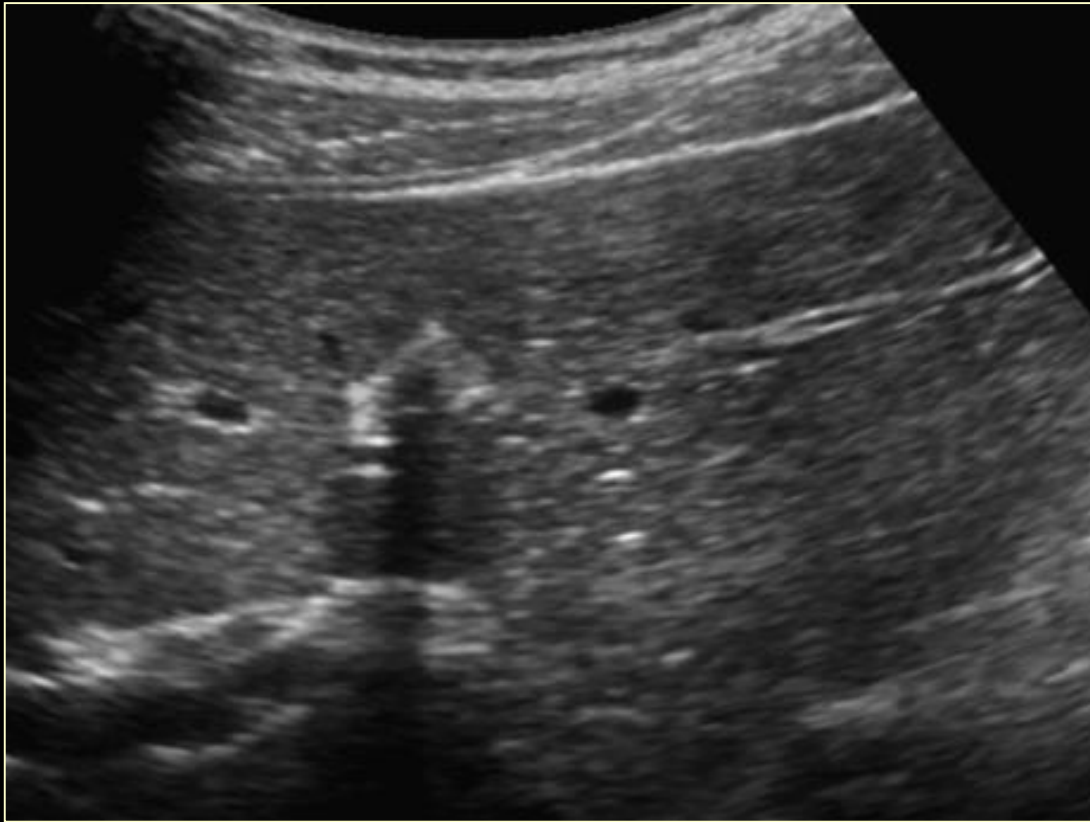


**Pg with IUD.**





# RUQ





# Pelvic scan.



# CROSS-SECTIONAL IMAGING

## NUCLEAR MEDICINE

External detection and mapping of the biodistribution of radiotracers that have been administered to a patient.

Poor spatial resolution, but high functional resolution.

Examples: Ventilation perfusion scan, bone scan, biliary scan, white blood cell scan, renal scan, thyroid scan, brain scan, PET, liver spleen scan



Ant



Post

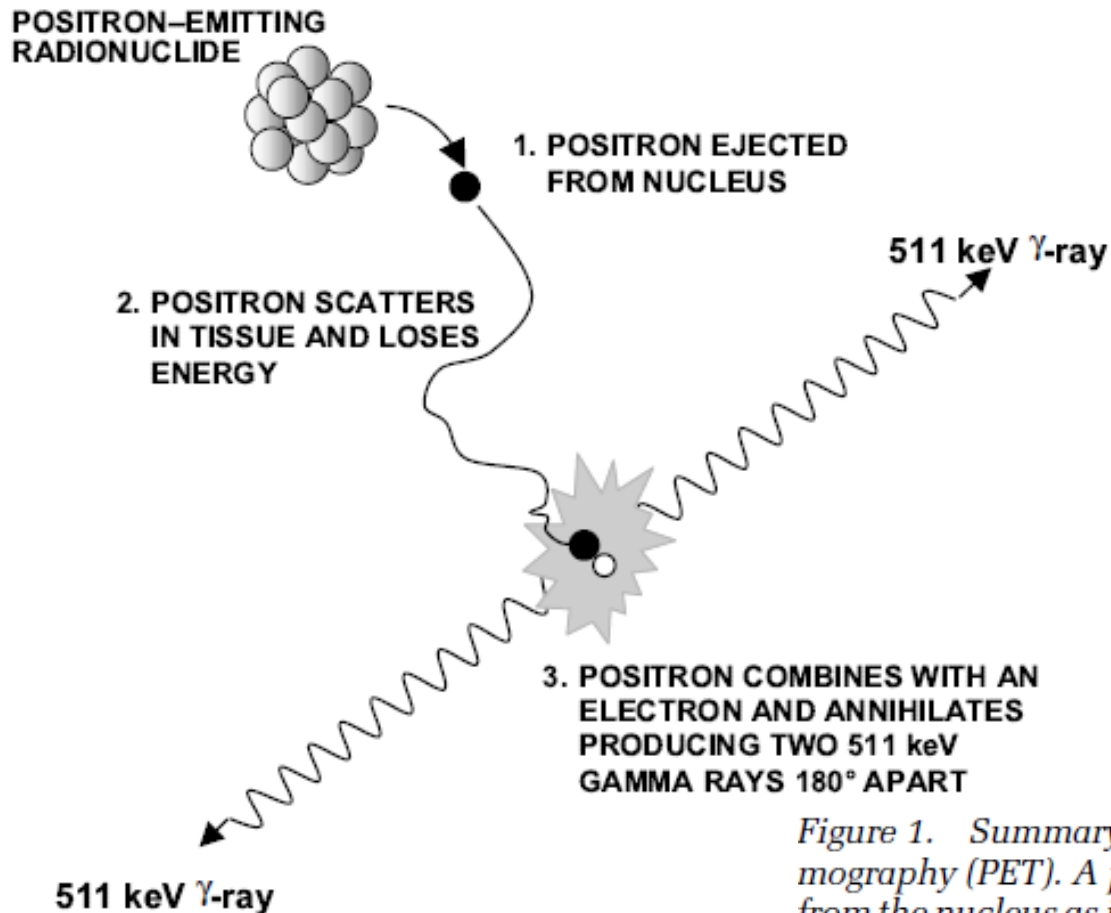


Ant



Post

# PET physics



*Figure 1. Summary of the physics underlying positron emission tomography (PET). A positron-emitting radionuclide ejects a positron from the nucleus as it decays. The positron travels a short distance in tissue (typically a few tenths of a mm), losing energy through interactions with atoms. Once it has reached thermal energies, the positron will combine with an electron in tissue and annihilate, simultaneously producing two 511 keV gamma rays that are emitted 180° apart.*



11



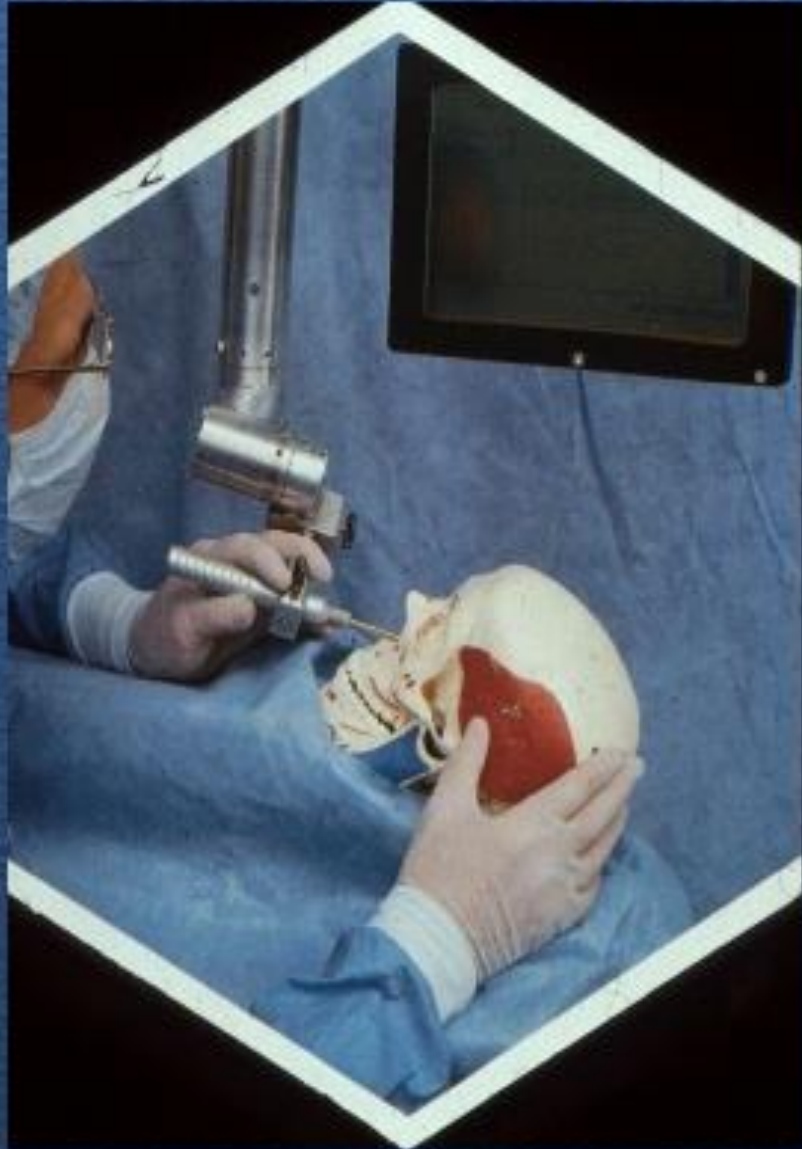
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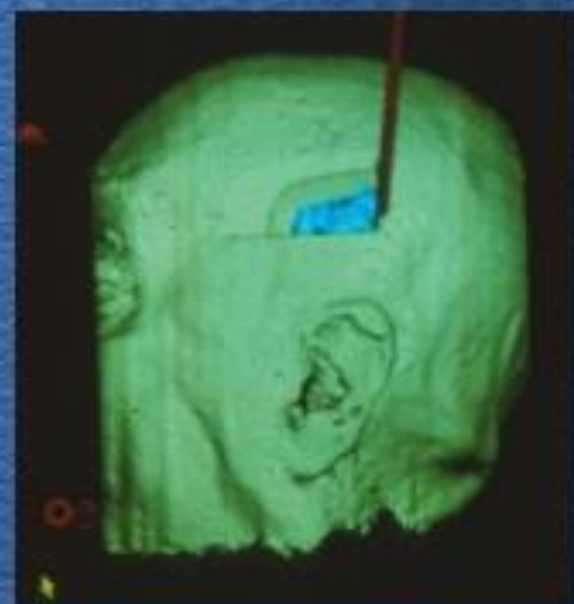
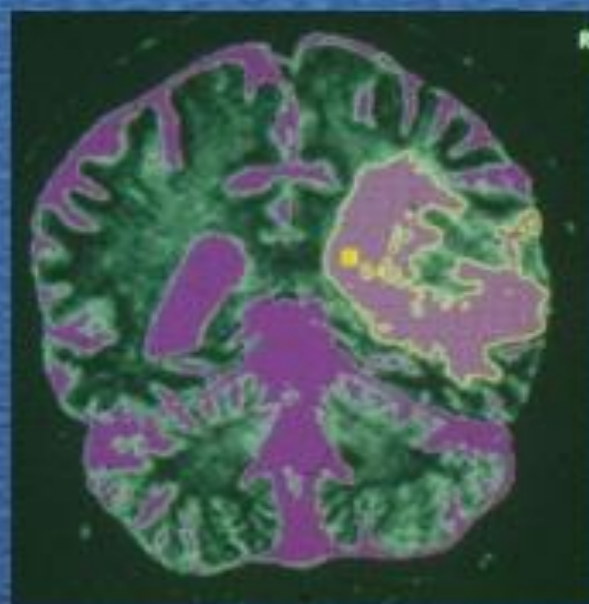
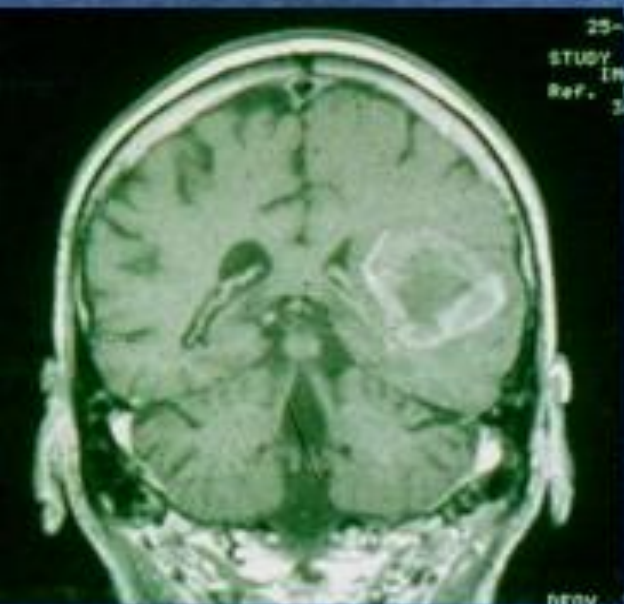
# Image-guided Surgery





# MRI/Glioblastoma

## Image-guided Surgery



# ORDERING AN EXAM



FOR CASHIERS USE ONLY DO NOT WRITE IN THIS SPACE

CHECK: AMB  WHEELCHAIR  STRETCHER

PRE OP  EMERGENCY  CALL EXT

DATE OF REQUESTION NO. DAY YR DATE OF LAST X-RAY AT C.P.M.C.

9 18 06

EXAM REQUESTED

Abdomen CT

CLINICAL INFORMATION

s/p cryoablation.  
? recurrent tumor

ICD9#

FOR CASHIERS USE ONLY DO NOT WRITE IN THIS SPACE

CHECK: AMB  WHEELCHAIR  STRETCHER

PRE OP  EMERGENCY  CALL EXT

DATE OF REQUESTION NO. DAY YR DATE OF LAST X-RAY AT C.P.M.C.

9/18/06

EXAM REQUESTED

CT abd

CLINICAL INFORMATION

R/O pain

ICD9#



# NEUROLOGIC IMAGING: BRAIN

## SPECIFIC SITUATIONS

Acute Trauma: Noncontrast CT



Stroke: Noncontrast CT followed by MRI



Seizure: 1<sup>st</sup> Seizure, contrast-enhanced MR or CT

Postictal state or residual neurologic deficit, Noncontrast CT

Chronic seizure disorder, detailed MRI



Infection and Cancer: contrast-enhanced MRI



Headache: Acute headache, noncontrast CT

Chronic headache with no neurologic Sx, noncontrast MRI

Chronic headache with neurologic Sx, contrast-enhanced MRI



Dementia: noncontrast MRI



# NEUROLOGIC IMAGING: SPINE

Acute Trauma: Plain film, CT if plain film findings equivocal ●

Everything else: MRI ●



# THORACIC IMAGING

Mainstay: Posteroanterior (PA) and lateral chest radiographs ●

Special views:

- Lateral decubitus: Small effusions or small pneumothorax ●
- Expiratory radiograph: Focal or diffuse air trapping
- Apical lordotic view: Visualization of lung apices
- Chest fluoroscopy: Diaphragmatic paralysis

# LIVER

- Contrast-enhanced multidetector CT (MDCT):  
Primary imaging method ●
- MRI with contrast: Inability to give iodinated contrast  
or need for multiple repeat examinations ●
- US: Screening method for patients with abdominal  
symptoms and suspected diffuse or focal liver disease,  
assessment of hepatic vessels ●

# PHARYNX AND ESOPHAGUS

Barium Swallow/Esophagram: Swallowing disorders and mucosal lesions ●

CT: Cancer staging, extent of disease ●

MR: Cancer staging, extent of disease, preferred for evaluation of nasopharynx ●

# URETHRA

Retrograde urethrogram: Anterior male urethra ●

Voiding cystourethrogram: Anterior and posterior urethra ●



# GENITAL TRACT

## FEMALE GENITAL TRACT

US: Primary imaging modality; Transvaginal vs  
Transabdominal ●

CT/MRI: Staging and follow up of pelvic malignancies ●

Hysterosalpingography (HSG): Congenital anomalies  
and causes of infertility ●

# GENITAL TRACT

## TESTES AND SCROTUM

Color US: Primary imaging method ●

CT/MRI: Tumor staging and locating undescended testes

