

Al-Mustaqbal University Colleg
Medical Physics Department



Medical Imaging

Lecture 1

Introduction to Medical Imaging

Second Stage

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1. Introduction to medical imaging

Medical Imaging refers to techniques and processes used to create images of various parts of the human body for diagnostic and treatment purpose.

History of Medical Imaging

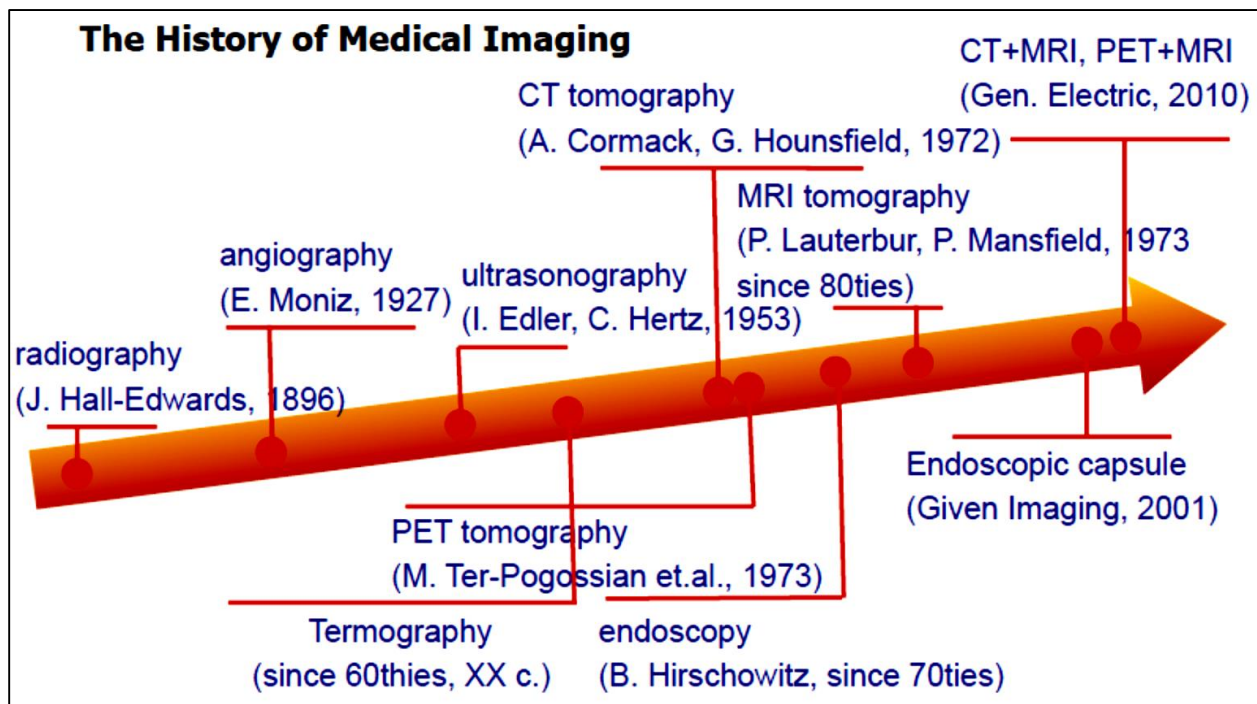
- ✚ The concept of medical imaging began in 1895 with the invention of the x-ray by a German professor of physics, Wilhelm Rontgen.
- ✚ Working with an early cathode ray tube called a Crooke's tube, he noticed that the invisible rays were able to penetrate some solids (like human flesh) better than others (like bone or metal)
- ✚ For his efforts he was awarded the first Nobel Prize in 1901.



- ✚ In the 1920s, the X-ray beam became more powerful and "**Fluoroscopy**" became possible.
- ✚ X-ray tomography was introduced in the 1940s, allowing "**tomograms**" or slices to be obtained through tissues.
- ✚ In the 1950's nuclear medicine started to be utilized as a way to diagnose pathology in the body. In these tests, the source of the X-rays is not an X-ray tube but rather

radioactive compounds, which typically emit gamma rays as they decay. They are combined with other compounds that are taken up as part of the disease process to study a particular problem.

- ✚ The most exciting test in nuclear medicine today is “*positron emission tomography*” or "PET" scanning.
- ✚ Ultrasound was first used clinically in the 1970s. Unlike X-ray and nuclear medicine, ultrasound uses no ionizing radiation - just sound waves.
- ✚ In the 1970’s Computed Tomography (CT scan) was developed.
- ✚ Also in the 1970’s the technology of MRI was developed which works on the principle of nuclear magnetic relaxation times.



2. Classification of medical imaging systems

1) X-ray radiography

- i) Plain Radiograph/X-ray
- ii) Computed Tomography (CT)
- iii) Fluoroscopy
- iv) Mammography
- v) Angiography

2) Magnetic Resonance Imaging (MRI)

3) Ultrasound

4) Nuclear Imaging

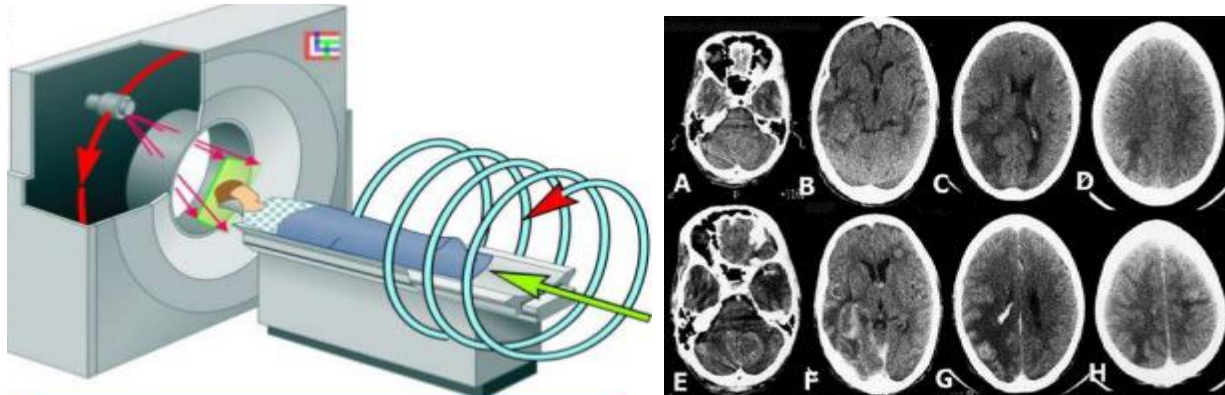
3. How does one type of image differ from another?

1) X-ray radiography

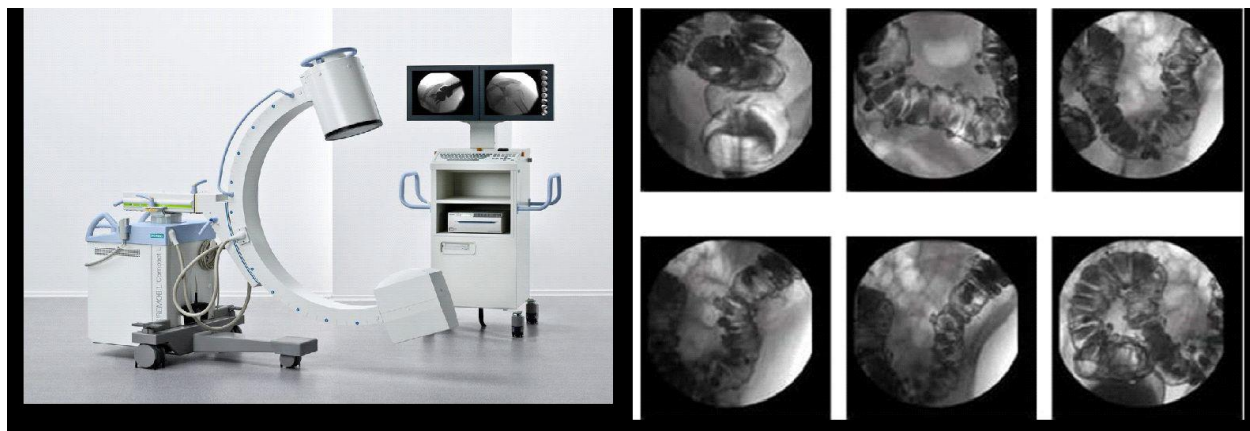
(i) Plain Radiograph/X-ray: Plain radiograph/X-ray is representing the simplest medical images of the human body by using X-ray.



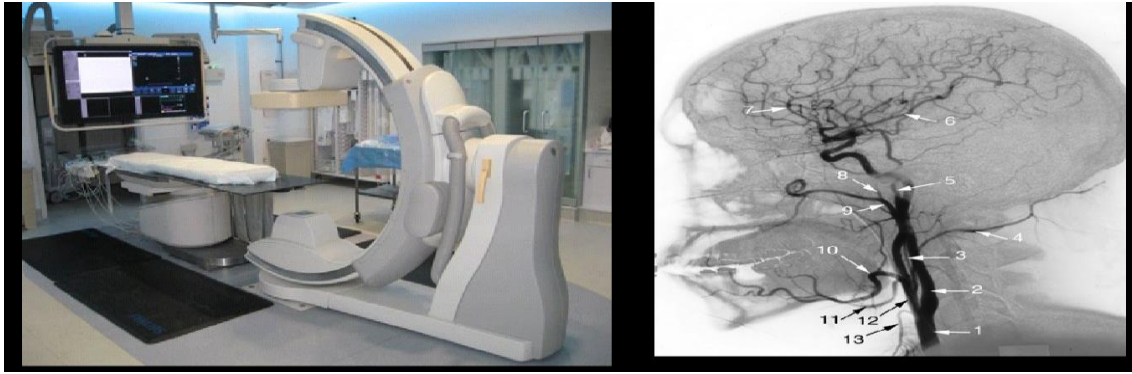
(ii) Computed Tomography (CT): is a medical imaging system that creates 3D cross-sectional images using complex x-ray from a ‘virtual pile of X-ray images’. The x-ray generator is rotated within 1° to 180° .



(iii) Fluoroscopy: Fluoroscopy is a type of medical imaging that produces a continuous live’ X-ray image.



(v) Angiography: is a type of X-ray technique for viewing blood vessels and organs, by injecting a contrast agent into the blood that enhances its visibility on the X-ray image.

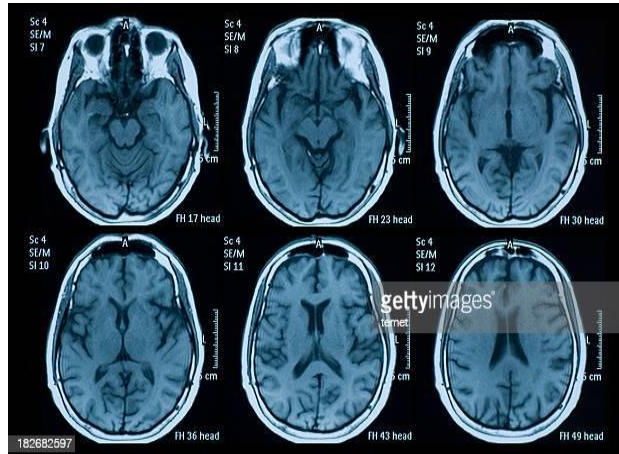
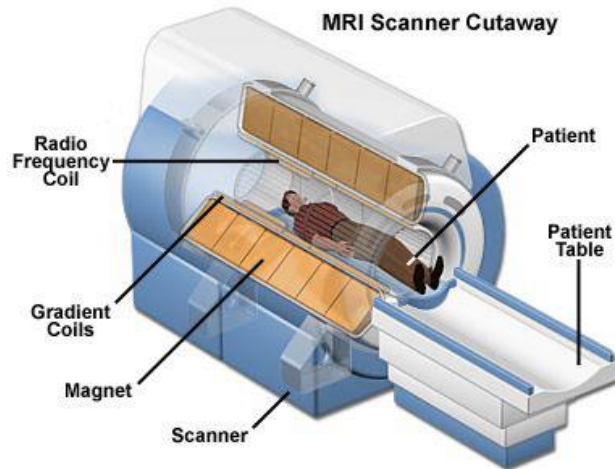


(iv) Mammography: is a type of X-ray imaging used to create detailed images of the breast and is commonly used in screening for breast cancer.



(2) Magnetic resonance imaging (MRI)

MRI is a medical imaging system for obtaining medical imaging of the inside of human body that used magnetic fields, radio waves and a computer. It takes a lot of a slice from a sections of body (cross sections) similar to a CT scanner, but does not use any radiation.



(3) *Ultrasound*

Ultrasound imaging: is a type of medical imaging that uses high-frequency sound waves (frequencies above 20,000 Hz - ultrasonic range) to look at organs and structures inside the body.



Ultrasound Procedure



Ultrasound Imaging

(4) Nuclear imaging

Nuclear medicine imaging: is a method of producing images by detecting radiation from different parts of the body after a radioactive tracer is given to the patient.



Nuclear medicine imaging

Nuclear medicine Procedure