التصوير الطبي

Medical Imaging

LECTURE THREE

Dr. Forat Hamzah

LECTURE THREE
Plain Radiograph/X-ray

3.1 Introduction

Medical imaging refers to techniques and processes used to create images of various parts of the human body for diagnostic and treatment purposes. The term, medical imaging, includes different radiological imaging techniques, such as:

i) X-ray radiography
ii) Ultrasound
iii) Magnetic resonance imaging (MRI)
iv) Nuclear imaging

Among these methods, medical imaging using X-rays is considered to be one of the important method employed to diagnosis of many diseases. There are many types of radiography using X-rays, such as:

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

Plain radiograph/X-ray is the imaging of parts of the body, using X-rays, which represent the simplest medical images created through X-radiation. In plain radiograph/X-ray, a beam of X-rays, produced by an X-ray generator, is transmitted through an object, e.g. the part of the body to be scanned. The X-rays are absorbed by the material they pass through in differing amounts depending on the density and composition of the material.

3.2 Properties of Plain Radiograph/X-ray

(i) Simplest medical images created using X-radiation

(ii) Provides fast

(iii) High-resolution images

(iv) Low-cost (relatively inexpensive)

(v) Does not require special preparation for the patient

(vi) plain X-rays are pictures of the chest and pictures of the arms, legs or spine in patients who have problems in the bones, joints.

3.3 Components of a Plain Radiograph/X-ray System

An X-ray spectrum with different energies is produced in a vacuum tube made of glass when an electron beam, emitted by a cathode, is fired at target material called an anode. The X-ray spectrum depends on the anode material and the accelerating energy of the electron beam. Most standard X-ray systems have many components which are;

(i) **X-ray tube** is an electrical device used for generation of X-ray, which constant from glass tube, cathode, and anode.

(ii) **X-ray detector (receptor):** are devices used to measure the flow, locative distribution, spectrum, and other properties of X-rays.

(iii) **Collimators:** is a device for producing a parallel beam of x-rays or radiation.

(iv) **Anti-scatter grid:** is a device placed between the patient and the image receptor, which will transmit most of the primary radiation but reject most of the scatter radiation

(v) **Couch with bucky tray:** which represent the holds the x-ray cassette (Silver halide film)

(vi) **Silver halide film:** X-ray film displays the radiographic image using silver halide (silver bromide (AgBr) is most common) which when exposed to light, produces a silver ion (Ag+) and an electron

(vii) **Control unit:** X-ray systems have three main components which are a X-ray tube, a high voltage power supply, and a control unit. ... You should recognize that electrical power is necessary for X-ray generation.

All of these components working together, these components are common to all standard systems, as shown in Figure 4.1 and Figure 4.2.

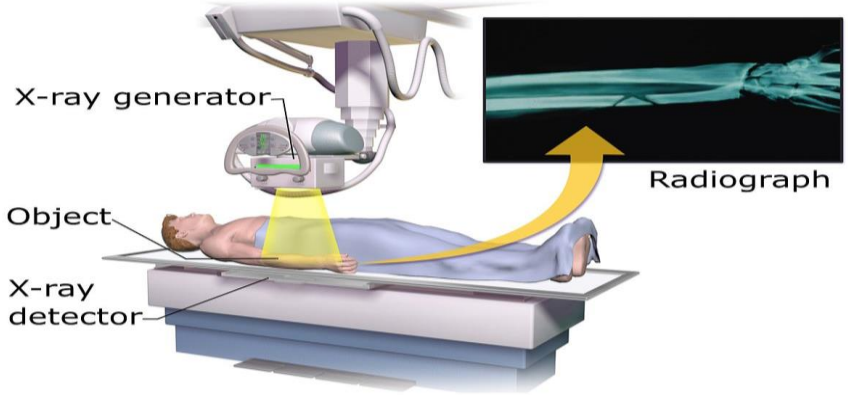

Figure 3.1; The components of a typical X-ray imaging system

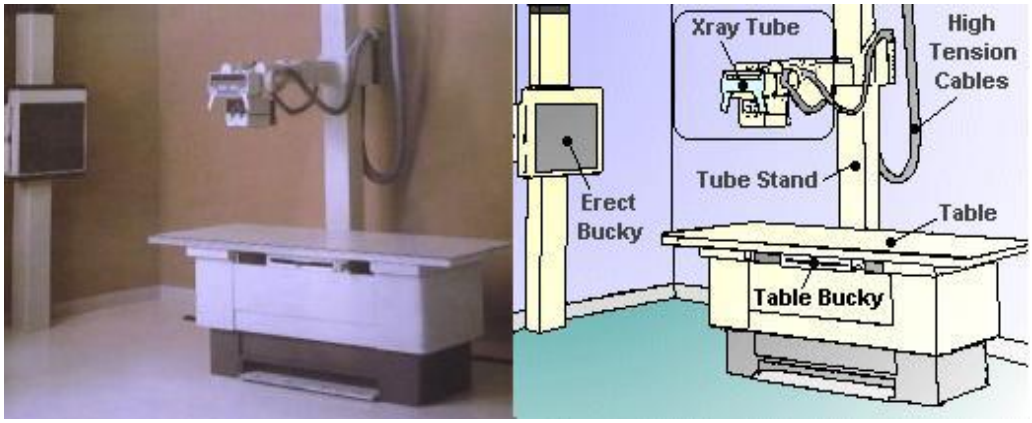

Figure 3.2: The X-ray Room.

3.4 Formation process of plain radiograph/x-ray

The radiographic image is formed by the interaction of X-ray photons with a photon detector, which are transmitted through the patient and are recorded by the detector. These photons can be either:

1) primary photons, which have passed through the patient without interacting, which carries useful information.
2) secondary photons, which result from an interaction in the patient (Figure 4.3). secondary photons not carry any useful information

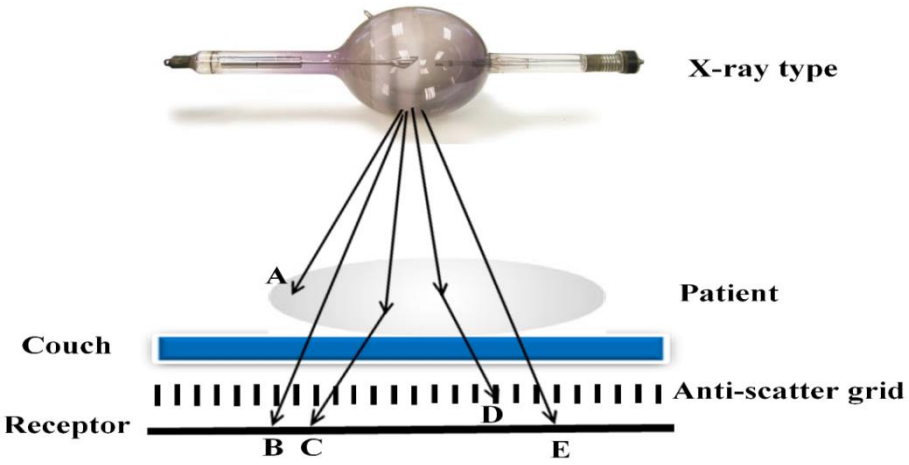

Figure 4.3: The components of the X-ray imaging system and the formation of the radiographic image. B and E represent photons that have passed through the patient without interacting. C and D are scattered photons. D has been stopped by an anti-scatter grid. Photon A has been absorbed.

The traditional technique of using x-rays to form images of the internal regions of our body involves sending x-rays through the body and onto a photographic film. If x-rays hit the film, then the film will react and turn dark. However, if the x-rays are absorbed by the body, they cannot reach the film and the film will appear white in those regions.

The photons emitted by the X-ray tube enter the patient. Patient is placed between X-ray tube and silver halide film. X-rays passed through the body are absorbed or transmitted in direct to tissue. X-rays penetrating the body to silver halide film and then turn it dark, the more x-rays that penetrate, the darker the area inscribed on the film. Bones & metal absorb or reflect X-rays are inscribed area on film is “lighter” or “more white. Soft tissues allow more X-rays to penetrate are inscribed area on film is “darker

Traditionally, medical X-ray images were exposed onto photographic film, which require processing before they can be viewed and take up a lot of space in hospitals and doctors' offices. Digital X-rays, which overcome these problems, have therefore become increasingly popular in radiography. Similar to a digital camera, an electronic detector is used instead of film. This "electronic image" is processed by a computer, enabling it to be stored digitally and viewed on screen immediately without processing.

Who is the operator of the Plain Radiograph/X-ray system? and who explains the radiograph (medical image)?

The operator of the plain x-ray radiography system is usually a radiologic technologist (radiographer), which selects the amount and type of X-rays to be used according to the patient's size, the tissue or part of the body being imaged and the amount of image contrast required, and then X-ray picture is stored on a piece of film called a radiograph.

These radiograph (medical image) are interpreted (explained) by a doctor specially trained to explain them, known as a radiologist.