

## Lecture 7 / Linear accelerator (linac)

### 1. Linear accelerator

#### WHAT IS LINEAR ACCELERATOR?

A linear particle accelerator is a type of accelerator that greatly increases the velocity of charged subatomic particles or ions by subjecting the charged particles to a series of oscillating electric potentials along a linear beamline. Linear accelerator is the device most commonly used for external beam radiation treatments ( teletherapy). In the last twenty years, radionuclide therapy has been widely used in various clinical malignant and pain whole body irradiation using external beam radiotherapy is impossible. Since the administration of radionuclides is minimally invasive and the duration of treatment is shorter than chemotherapy, targeted radionuclide therapy has become one of the most preferred types of cancer therapy.



## 2. HISTORY OF Linear accelerator

**HISTORY** In the late 1940s, the idea of using linear accelerator in the medical application become interested. Medical Linear Accelerators have been in clinical use since the early 1950s. During the past 70 years medical linacs have gone through 5 distinct generations. Each of the 5 generations introduced new

### How it works

- ❖ Used to treat all parts and organs of the body
- ❖ Uses microwave technology to accelerate electrons in the part of the accelerator called the wave guide, then allows the se electrons to collide with a heavy metal target
- ❖ The high energy x-rays are shaped as they exit the machine to conform to the shape of the patient's tumor

### How It Works Continued

1-X-ray treatments are designed in a way that destroy the cancer cells while sparing the surrounding normal tissue

2-High energy photons enter the patient's body and aim to break the DNA in all the cells within the treatment area The good cells are able to mend themselves

3-The cancerous cells are unable to do this and therefore die

4-Patient lies on a moveable treatment couch which can move in any direction

5-The beam comes out of a part of the accelerator called a gantry, which can be rotated around the patient

6-Radiation is delivered to the tumor from any angle by rotating the gantry and moving the treatment couch

### **3-Advantages**

1-Advantages: particles are able to reach very high energies without the need for extremely high voltages

2- Linear accelerators attack the affected area with higher doses of radiation than other machines

### **4-Disadvantages**

1-Disadvantages: A linear accelerator can cost anywhere between one million and three million dollars.

2-Operating the machine costs about \$900,000 annually. The particles travel in a straight line, each accelerating segment is used only once. The segments run in short pulses, limiting the average current output and forcing the experimental detectors to handle data coming in short bursts, thus increasing the maintenance expense

