Al-Mustaqbal University College
Radiological Techniques Department

RADIATION PROTECTION

Ionizing Radiation Exposure Effects

Third Stage

Fifth Lecture

By
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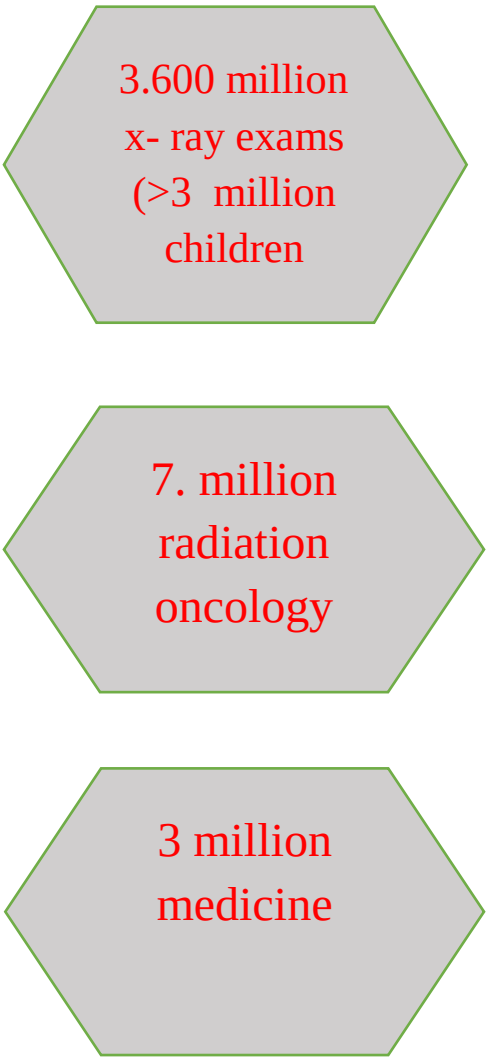
Ionizing Radiation Exposure Effects

The largest contributor to the exposure of the general population from artificial sources:



Use of radiation in health care

❖ Benefits for patients gain recognition: the use of radiation in the diagnosis and treatment of human diseases increases

❖ Development of modern health technology makes new applications safer

❖ However, the inappropriate use can lead to unnecessary or unintended radiation exposures with potential health hazards for patients and staff.

Radiation effects (I)

- ▪ Radiation can induce cell killing, extensive enough to impair the function of the irradiated tissues or organs.
- ▪ These effects are clinically observable if the radiation dose exceeds a certain threshold.
- ▪ These are called(tissue reactions), Frequency and severity increase with the dose. e.g. cataract, skin damage, nausea, vomiting, sterility, epilation

Radiation effects (II)

- ▪ Radiation can also induce non-lethal transformation of a cell that still maintains its reproductive capacity.
- ▪ This might lead to cancer in the exposed individual after a latency period (years) or to heritable effects in the offspring. These are called (stochastic effects)

Types of radiation effect

The effects of radiation on the human population can be classified as:

1. **Somatic effects:** are harm that exposed individuals suffer during their lifetime, such as radiation induced cancers (carcinogenesis), sterility, cataract, and life shortening.

2. **Genetic or hereditary effects:** (Future Generations) Is radiation-induced mutations in an individual's genes and DNA that can contribute to the birth of defective descendants. In other words, are seen in the offspring of the individual who received the radiation, such as

Anemia

Epilepsy

Diabetes

Asthma

3. Teratogenic effects: (Offspring while in-utero): Teratogens are drugs, chemicals, or even infections that can cause abnormal fetal development. There are billions of potential teratogens, but only a few agents are proven to have teratogenic effects. These effects can result in a baby being born with a birth defect. Approximately 4 to 5 percent of birth defects are caused by exposure to a teratogen. Such as mental retardation malformations

4. Stochastic effects: Radiation exposure can also induce delayed effects such as malignancies, which are expressed after a latency period and may be epidemiologically detectable in a population; this induction is assumed to take place over the entire range of doses such as (Cancer). The probability of effect occurring increases as doses increases. The probability

of occurrence of cancer is higher for higher doses, but the severity of any cancer that may result from irradiation is independent of dose.

5. **Deterministic effects:** At large doses, radiation effects such as nausea, reddening of the skin or, in severe cases, more acute syndromes are clinically expressed in exposed individuals within a relatively short period of time after the exposure; such effects are called deterministic because they are certain to occur, if the dose exceeds a threshold level.

Deterministic effects are the result of various processes, mainly cell death or delayed cell division, caused by exposure to high levels of radiation. A deterministic (non-stochastic) effect is one which increases in severity with increasing dose in affected individuals (organ atrophy, fibrosis, lens opacification, blood changes, decrease in sperm count).

The harmful effects of radiation depend on several factors:

1. radiation dose
2. The speed of receiving the radiation dose
3. The area of the body exposed to radiation

4. sensitivity of the tissue exposed to radiation
5. The presence of genetic abnormalities that impede the normal repair processes of DNA
6. The person's age at the time of exposure
7. The general health condition of the person before exposure to radiation