

BASICS OF RADIATION BIOLOGY (RADIOBIOLOGY)

206 BIOCHEM

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Side effects

- ▣ As radiation dose increases, tissue changes become more profound and irreversible → increased complications.

- ▣ Important variables:
 1. Number of fractions الجلسات
 2. Dose per fraction
 3. Total dose
 4. Time period

Radiation therapy FRACTIONATION

- ▣ Radiation therapy is delivered in the series of treatment or fractions.

“Conventional (Conservative) fractionation” (in US)

- ▣ total dose - 6500 to 7200 cGy
- ▣ daily fractions -180-200 cGy
- ▣ period- 7 weeks
- ▣ given Monday through Friday

The centigray (cGy) is a unit of measurement of radiation (e.g. X-rays) absorbed dose.

Interactions of Radiation and Tissues

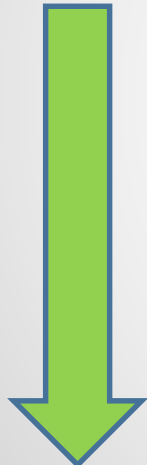
Interactions include:

1. Radiation absorption by tissues
2. Biologic effects
3. Reoxygenation
4. Repopulation
5. Accelerated repopulation

Interactions of Radiation and Tissues

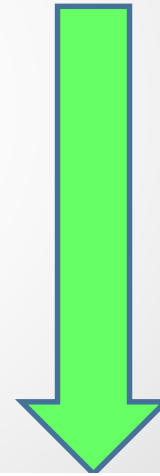
Radiation absorption by tissue

Radiation absorption by tissue results in:



Direct ionizing

Or



Indirect Ionizing

Interactions of Radiation and Tissues

Radiation absorption by tissue

- When charged particles have sufficient energy , they are **directly ionizing**.
(pass through target tissue, and disrupt the atomic structure by producing chemical and biological changes).
- Photons and neutrons (uncharged particle) are **indirectly ionizing** .(give up their energy to produce fast moving charged particles.)

Interactions of Radiation and Tissues

Biologic effect

- ▣ The primary effect of radiation is usually limited to the intranuclear structures such as DNA and mitotic apparatus.
- ▣ Damage to intranuclear structures may be;
 1. lethal
 2. sublethal (may not be apparent until at least one cellular division is attempted).
- ▣ If enough time passes between the sublethal event and cellular division, the damage may be corrected, process known as repair of sublethal damage.

Interactions of Radiation and Tissues

Reoxygenation

- ▣ The indirect action of photon beam on target tissues is dependent on the level of oxygenation concept known as **reoxygenation**.
- ▣ **Anoxic tissues - 3 times more resistant to radiation effects**
Specifically, **anoxia** is a condition in which there is an absence of oxygen supply to an organ's **tissues** although there is adequate blood flow to the **tissue**.
$$\text{oxygen} + \text{organic free radicals} = \text{organic peroxides}$$
- ▣ This reaction leaves more hydroxyl free radicals which can then interact with target molecules.

Interactions of Radiation and Tissues

Redistribution

- ▣ The radiation effect on individual cells may vary according to the position they occupies in the cell cycle at the time of irradiation.
 - ✓ More vulnerable (at risk) during G1 and in mitotic phase
 - ✓ Relatively radioresistant at the beginning and the end of DNA synthesis.
- ▣ Radiation given during these phases, increased cell killing, known as **redistribution**.