# Radiotherapy

**Radiotherapy** (RT) is the use of **ionizing radiation** to destroy or damage cancer cells by inducing DNA damage, leading to cell death. It is a key modality in the treatment of solid tumors, often used alone or in combination with surgery, chemotherapy, or immunotherapy.

## **Types of Radiotherapy**

#### • External Beam Radiotherapy (EBRT):

- Delivered from a machine (e.g., linear accelerator)
- Includes techniques such as:
  - 3D conformal radiotherapy (3D-CRT)
  - Intensity-modulated radiotherapy (IMRT)
  - Image-guided radiotherapy (IGRT)
  - Stereotactic radiosurgery (SRS) and stereotactic body radiotherapy (SBRT)
- Brachytherapy:
  - $\,\circ\,$  Internal radiation by placing radioactive sources inside or near the tumor
- Systemic Radiotherapy:
  - $\,\circ\,$  Use of radioactive isotopes (e.g., I-131 for thyroid cancer)

#### **Mechanism of Action**

- Causes DNA single- and double-strand breaks
- Generates **free radicals**  $\rightarrow$  cytotoxic effect
- Induces apoptosis, senescence, or mitotic catastrophe
- Preferential effect on rapidly dividing tumor cells

### **Clinical Applications**

- Curative intent: e.g., localized prostate, head and neck, brain tumors
- Adjuvant/Neoadjuvant: Combined with surgery or chemotherapy
- **Palliative**: Symptom control (e.g., bone metastases, spinal cord compression)
- Radiosurgery: Precise, high-dose delivery to small targets (e.g., brain metastases)

### **Adverse Effects**

- Acute:
  - Skin erythema, mucositis, fatigue, nausea
- Late:
  - $\,\circ\,$  Fibrosis, radiation necrosis, second malignancies, organ dysfunction

### **Emerging Concepts**

- Abscopal effect:
  - $\circ$  Systemic anti-tumor response after localized RT, often linked to immune activation
- Radiation-induced immunosuppression:
  - Some settings show paradoxical promotion of metastasis via immune cell reprogramming (e.g., AREG induction)
- Combination therapies:
  - RT + immunotherapy
  - RT + EGFR inhibitors

#### **Dose and Fractionation**

- Conventional: 1.8-2 Gy per day
- Hypofractionated: Larger doses over fewer sessions
- Hyperfractionated: Smaller doses given more than once daily

### **Related Topics**

- Combination Therapy
- Abscopal Effect
- Radiation Necrosis
- SBRT vs SRS
- Radiotherapy Planning

From: https://neurosurgerywiki.com/wiki/ - **Neurosurgery Wiki** 

Permanent link: https://neurosurgerywiki.com/wiki/doku.php?id=radiotherapy



Last update: 2025/05/15 07:18