



Radiation Oncology: IMRT vs. SRS vs. SRT vs. SBRT

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Speaker Introductions

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Keeping Up With Advances in Radiation Oncology

- Rapidly advancing technology has:
 - Increased complexity and accuracy of radiation therapy
 - Led to specialization in the types of technology used for different cancer sites
 - Presented the challenge to healthcare policy-makers and providers to integrate innovations into routine practice, guidelines, and coverage
- Education may curb overutilization

IMRT, SRS, SRT, and SBRT

- All are non-invasive treatments
 - High doses of focused radiation beams are precisely delivered to target tumors
- IMRT = intensity-modulated radiation therapy
- SRS = stereotactic radiosurgery
- SRT = stereotactic radiotherapy
- SBRT = stereotactic body radiation therapy

Intensity-Modulated Radiation Therapy (IMRT)

- Delivers precise radiation doses to malignant tumor or specific areas within the tumor; minimizes dose to surrounding critical structures
- Uses computer-controlled linear accelerators to deliver precise radiation doses

IMRT

- **Targets**

- Used most extensively to treat cancers of the prostate, head and neck, and central nervous system
- Limited use to treat breast, thyroid, lung, gastrointestinal, gynecologic malignancies, and certain types of sarcomas

- **Dosing**

- Maximizes radiation dose distributions to the target while reducing exposure of adjacent non-target structures
- Conforms more precisely to the 3-dimensional shape of the tumor
- Delivered via conventional linac-plus-multileaf collimator (MLC) with photons

Stereotactic Radiation Therapy

- Utilizes specific image guidance for exact localization of tumors or areas of concern in the body or brain
- Delivers high-dose radiation to a small highly precise treatment field
- Excludes normal surrounding tissues/organs better than conventional radiotherapy

Stereotactic Radiosurgery (SRS)

- Utilizes an IMRT plan that delivers a large, single intracranial dose of radiation on a single day
- Targets tumor from many different directions, with beams of radiation converging on the tumor
- Delivers high doses of radiation with millimeter accuracy

Stereotactic Radiotherapy (SRT)

- Utilizes an IMRT plan with intracranial hypofractionation
- Delivers multiple smaller fractionated doses (2 to 5), which allow potential for higher total doses of radiation

SRT: Rationale for Fractionation

- Results in the highest “therapeutic ratio”
 - The highest destruction of tumor cells with the lowest effect on normal adjacent tissue and structures
- Tumor and normal tissues respond differently to high single doses vs. multiple smaller doses of radiation
 - Single large doses can irradiate normal tissue more than smaller doses
 - Multiple smaller doses can destroy tumor cells while sparing normal tissues

Stereotactic Body Radiation Therapy (SBRT)

- Utilizes an IMRT plan for body lesions
- Refers to the use of SRT at any extracranial site
- Requires accurate and custom mapping for each individual patient's anatomy and organ motion in order to optimally target the tumor
- Some lesions require fiducial marker placement for improved image-guided accuracy

SBRT: Palliative and Curative Use

- Palliative
 - Lung or liver cancer
 - Cancer of the spine
- Curative
 - Proven for stage I nonsmall cell lung cancer

Examples of Available Technologies

Examples of Most Widely Used Technologies

- Multileaf collimator-based linear accelerators
- CyberKnife®
- Gamma Knife®
- TomoTherapy®

CyberKnife

- Specialized linear accelerator system that uses geometric triangulation of target tissue
 - A single high-energy photon beam fixed to a robot arm moves to different positions during the course of treatment, converging in the treatment area
- Eliminates need for immobilization frames
- Used primarily for stereotactic approach to brain or body lesions



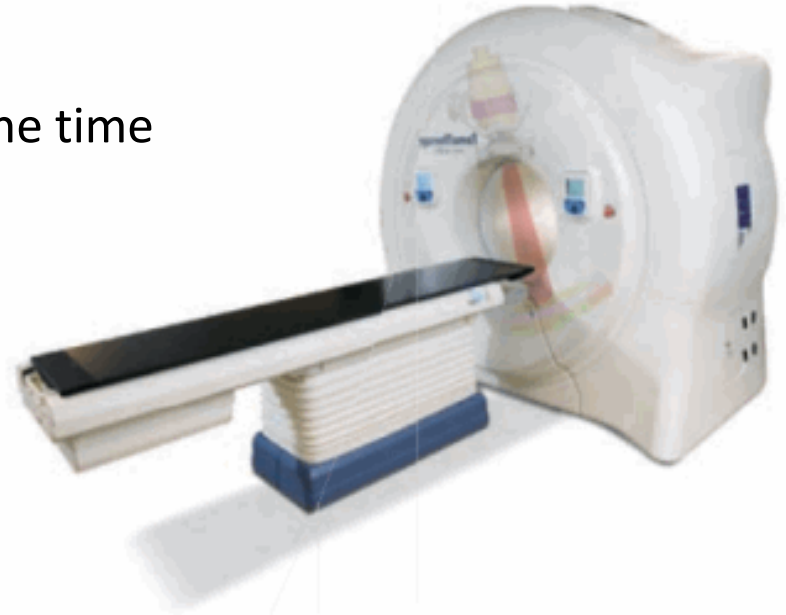
Gamma Knife

- Delivers focused beam of high-energy particle radiation
 - Multiple beams of gamma radiation converge in 3 dimensions to focus precisely on a small volume (e.g., a tumor)
- Skeletal frame immobilizes target area
- Almost exclusively used for intracranial lesions



TomoTherapy

- Integrates CT imaging with IMRT
- Radiation is delivered slice-by-slice
 - Entire tumor volume is irradiated at one time



Advances in Radiation Oncology: The Challenges

- Often complicate the process of establishing evidence-based criteria for practice guidelines and reimbursement for new procedures
- Clinicians may try to justify using a new technology by citing studies that are too small and lack statistical power

Oncology Case Management: The Role of External Review

- Independent medical review
 - Avoids conflicts of interest
 - Facilitates effective treatment of patients, which requires in-depth understanding of the radiation treatment planning process
- Physician specialists provide up-to-date, evidence-based decisions and determine whether procedures meets latest standard of care as technologies continue to evolve

Questions and Answers for Our Doctors

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Thank You



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