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Are You Ready When Patients Undergoing Radiotherapy Have Such Implanted Devices?

Challenges in PBS Proton Spine SBRT
- We know the protons stop, but we do not know exactly where – need to account for range uncertainties
- Changes in the beam path translate to range errors, which eventually affect doses
- Enhanced RBE at the distal end of the beam, need to account for beam ending on OAR’s by increasing beam number, but also keeping integral dose minimized
- Higher surface dose to skin and chest wall
- Hardware uncorrected for proton therapy planning maximum percentage range of dosimetry effect can be up to over 21%

Challenges in PBS Proton SBRT-Hardware

CT Simulation

Proton Treatment Planning

SBRT Patient - IGRT
- X-ray/CT alignment
- Bone around target volume (ROI + CTV+2 cm)
- Clips or markers if available
- Realign between treatment fields to verify patient's position
- Daily CT/CTs align soft tissue
- Highly reproducible positioning must be maintained in every treatment
- Planning margins vary for sites (3–beams)
- Tolerance: <2 mm for all sites
- Major Concerns:
  - Limited dose smearing due to <5 fractions and every treatment matters to the outcome
  - Longer beam and treatment time due to higher prescribed daily dose and repainting for moving target

Attention!

Not too much concern as no beam passes through here
Discussions

- Titanium insert will not be shoot through during proton planning which will lose some target coverage
- However, the spine uncertainty will be more robust since the dose is not conformal to the spine cord
- CFR-PEEK insert will allow shoot through during proton planning as the normal spine

Summary

- Four types of spine configurations were planed and compared
- CFR-PEEK insert has similar to normal spine characteristics for proton planning
- CFR-PEEK insert can improve target coverage and OAR sparing therefore
Summary of PBS SPINE SBRT

- SBRT is an excellent modality for management of spinal mets and primary tumors
- Due to the lack of proton exit dose, proton SBRT can be of benefit in achieving the same high local control, but with reduced toxicity
- Proton SBRT planning does have challenges, including range uncertainty, skin dose, sensitivity to metal/titanium, RBE
- In order to further test the benefit of proton SBRT, we will begin with a dosimetric photon vs. proton SBRT study

Thank you for your attention!