Clinical Challenges and Pitfalls for SBRT

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Therapeutic Modalities

Chemo
Systemic

Radiotherapy
Locoregional

Surgery
Local
SBRT

- SBRT radioablative doses characterized by
  - extremely large dose per fraction
  - limited number of fractions (<5)
  - negligible fractionation effects
- any tissue receiving a full radioablative dose are
  - irreversibly damaged
  - negligible recovery and repair
- radioablation of normal tissue limits which organs can be safely treated with SBRT
  - serial vs. parallel
Organ at Risk Sparing
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- lungs are have both serial and parallel organization → mixed
- ablation is tolerable only for parallel organs
  - redundancy needed
  - surgical resection of proximal bronchial tree only possible because ablated section repaired
- minimize toxicity by
  - constraining location of SBRT to peripheral lung → parallel
  - tight conformal dose distribution → steep dose gradients
Paraspinal SBRT

• because spinal cord is serial, SBRT technique tolerances used for parallel structures inadequate
• serial structures require very steep dose gradients to treat safely
• every link in therapeutic chain must be strong
  • immobilization: VacLok™, Vacuum Bag Cushion System
  • delineation: MR sim, myelogram
  • planning: VMAT
  • verification: IGRT, hexapod
  • delivery: high dose rate
Immobilization
Delineation

- accurate and precise spinal cord delineation critical (~1 mm) → MR sim, myelogram (hardware)
- tolerances for other links should be similarly tight
- PRV margin is 1.5 mm
Planning

- VMAT uses continuous modulated arcs to deliver RT
- has better treating efficiency compared to step and shoot
- this, combined with high intensity dose rates, can significantly shorten overall treatment time
- risk of positional drift greater with
  - longer treatment times (>20 minutes)
  - poorer performance status patients
Verification

- paraspinal SBRT feasible only with IGRT
- tolerances tight (<1 mm, <1°)
- corrected with hexpod
- most challenging are “donut” targets
Thank you for your attention