Stereotactic Body Radiotherapy (SBRT) for Kidney Cancer

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Treatment Options of RCC

**Invasive Treatment options**
- Surgery
  - Nephrectomy
  - Partial Nephrectomy
- Ablation
  - Radiofrequency
  - Microwave
  - Cryo

**Non-invasive Treatment Options**
- Systemic Therapy
  - Targeted agents
    - Pazopanib
  - Immune checkpoint Inhibition
  - Chemotherapy
- Stereotactic Radiation (SBRT)
  - MRI guidance
Stereotactic Radiation for Renal cell Carcinoma

• Effective
  • Ablative doses avoids radio-resistance. Similar to Radiosurgery

• Highly Conformal
  • Preserve residual renal function

• Non-invasive
  • No anesthesia, low risk

• Few Complications
Patient Selection Considerations

• High risk or medically inoperable patients
• Large or unresectable lesions
  • vascular or ureteral involvement
• Hematuria
  • Stop bleeding and decrease vascularity
Single Institution Experiences

• Siva et al (Literature Review)

  • 10 single institution studies
  • Stereotactic Radiation 36-48 Gy (biologic equivalent dose of 79-105 Gy)
  • Estimated 2 Year Local Control 91-100%
  • >Grade 3 toxicity 3.8%
Stereotactic Ablative Radiation to Superior Pole Lesion
Realtime MRI Confirms Correct Kidney Position

• Tumor tracking required to spare uninvolved kidney

• Tracking algorithm works very well with nice contrast difference

• Radiation turns on/off automatically when tumor is in position
Durable response in right kidney metastasis with MRI guided partial kidney SBRT

- Superior portion of the right kidney shows no evidence of residual metastasis
- Residual right kidney appear to remain functional with normal metabolism
Stereotactic radiation for RCC

Radiation Plan

MRI During Treatment
Combination Stereotactic Radiation with Microwave Ablation

• ablation (microwave) control rates decrease as lesions size increases
  • <4cm = control ~95%
  • >4cm = control ~65%

• Larger RCC lesions adjacent to bowel or stomach

• SBRT for lesions touching bowel or stomach make cause retraction away from bowel, but leaves a portion of the lesion potentially undertreated.
Phase I: Microwave ablation with MRI-Guided SBRT Boost in Renal Cell Carcinoma

SBRT (week 1 and 2)

Dose-escalation levels (for Phase Ia):
- Dose level I: 6 Gy x 5 fractions
- Dose level II: 8 Gy x 5 fractions
- Dose level III: 10 Gy x 5 fractions

Dose-level for Phase IB will be based on the MTD from Phase IA

Four weeks after SBRT completion: Assessment for ablation

Microwave ablation 8 weeks from the completion of SBRT

Tissue for immune response etc
Summary

• Stereotactic Radiation offers excellent local control for medically inoperable RCC

• Another in the line of effective treatment options

• Advantages of MRI Guided Tracking

  • Soft Tissue Resolution
    • Improved alignment
    • Confidence using high dose near critical organs

  • Motion management – Breath hold and Tracking
    • Decreased normal tissue/increase tumor dose
    • Improve image quality

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Thank You

• Andrzej Wocjiecynski MD
• Paul Harari MD
• Mark Ritter Md PhD
• John Bayouth PhD
• Mark Geurts MS

• Jason Abel MD
• Sara Best MD
• Fred Lee MD
• Meghan Lubner MD
• Richard Chappell PhD