PROSTATIC ADENOCARCINOMA

Outcome and Follow-up:

Morbidity for this case:

- Pre-CK: IPSS 4, BM normal, SHI 23, No Flomax
- 2 week: IPSS 14, (+) dysuria, On Flomax, Increased BM frequency
- 1 month: IPSS 18, (+) dysuria, On Flomax, BM better but "not normal"
- 2 month: IPSS 3, Off Flomax, BM normal, SHI 22
- 4 month: IPSS 5, Back on Flomax (Improved urinary flow with it), BM normal, SHI 16
- 6 month: IPSS 5 - On Flomax, SHI 10 (tadalafil prescribed), BM Normal
- 12 month: IPSS 10 - Off Flomax, SHI 19 (responsive to tadalafil), BM frequency mildly increased (recommended decrease in dietary fiber)

Conclusion and CyberKnife Advantage:

CyberKnife radiosurgery was selected by this patient because of its precision, and he also appreciated the compressed time course of treatment delivery compared with conventional radiotherapy. Our approach has been designed to mimic HDR brachytherapy dosimetry, as HDR brachytherapy naturally escalates the dose to the peripheral zone of the prostate, which typically harbors the majority of cancer cells.1 HDR brachytherapy also has compelling literature demonstration of efficacy and safety.2 Based on the unique radiobiology of prostate cancer, which is particularly sensitive to large dose per fraction (hyperfractionated) radiation treatment, there is solid biologic rationale for treating prostate cancer patients in this manner.3 Clinical experience remains limited, but there are emerging data indicating a favorable PSA response to CyberKnife prostate radiosurgery, with a median 18-month PSA result of 0.22 ng/ml.4 Our own study demonstrates a consistent, significant early biochemical response, with the above illustrated PSA graph being typical of our experience to date.5 Treatment related toxicity to date has included grade I-II urinary symptoms that normally resolve in 4 – 6 weeks, and grade 0-I rectal symptoms that normally resolve in 2 – 3 weeks.

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DEMOGRAPHICS:

Sex: M
Age: 76
History: Healthy, asymptomatic retired executive, presented with PSA 7.7 ng/ml Jan 2006, 9.4ng/ml – June 2006
Treat Date(s): July 2006

CLINICAL HISTORY:

Diagnosis: Prostate biopsy April 2006 (+)
Gleason Score 3+3=6
Adenocarcinoma involving 30% of tissue submitted
Stage T2a (palpable nodule R base)
Bone Scan, CT abdomen/pelvis - May 2006
No evidence of metastatic disease

TREATMENT DETAILS:

Tumor Volume: 55cc
Imaging Techniques: CT, MRI
Rx Dose & Isodose: 38 Gy to 57%
Conformation Index: 1.10
Tumor Coverage: July 2006

CyberKnife Treatment Rationale:

The Virtual HDRsm CyberKnife Monotherapy Protocol was initially developed by principal radiation oncology investigator, Donald B. Fuller, M.D., of the CyberKnife Centers of San Diego. This protocol is IRB approved, and began enrolling patients in July 2006.

Working Concept:

- We model our Cyberknife (CK) approach after High Dose Rate (HDR) brachytherapy, using peer reviewed HDR dose fractionation and comparable dose molding
- CK represents a non-invasive HDR delivery tool

Endpoints:

Primary: Detailed Baseline and follow-up QOL analysis
Secondary: PSA-based DFS
Tertiary: Compare Cyberknife vs. HDR brachytherapy dosimetry directly

Planning Process and Goals:

Two Image sets:
- "A" series = 16 detector CT; 1.5 mm slices
- "B" series = T1 fat sat MRI (1.5T) with Gadolinium; 2 mm slices to better define prostate capsule, rectal mucosa, NVB structure and penile bulb

A foley catheter was used to image the urethra for both image sets and there was 100cc H2O in the bladder for both image sets. This was also done with an empty rectum (Fleets).

Dosimetry

- Rx 57% isodose line; New Conformality Index - 1.10
- PTV/100% - 96.6%, 1150 - 10.4%, D90 - 39.6 GY
- Urethra: Dmax - 44Gy (116%); Median - 38.4Gy (101%)
- Rectum Outer wall: Dmax - 34.7Gy (91%)
- Rectum Mucosa: Dmax - 25.3Gy (67%)
- NVB: Steep gradient: 48Gy (126%) - 26.8Gy (71%)
- Penile Bulb: Dmax - 22.7Gy (60%); D50 - 7.3Gy (19%)

Treatment Delivery

Four transperineal prostate fiducials were placed and CT/MRI co-registered treatment planning - July 2006.

The patient was treated with 3800 cGy in four fractions - July 2006.

Case History:

The patient presented during a routine health appraisal evaluation with a PSA of 7.7 ng/ml dated January 2006. A prostate biopsy was conducted April 2006, revealing Gleason Score 3+4=7 adenocarcinoma involving 30% of the submitted tissue (the cancer location within the prostate was not further specified). A bone scan and CT of the abdomen/pelvis May 2006 showed no evidence of metastatic disease. His repeat PSA level in June 2006 measured 9.4 ng/ml.

During his initial radiation oncology evaluation he was found to have an International Prostate Symptom Score (IPSS) of 4 and Sexual Health Inventory (SHI) score of 23; Stage T2a lesion at the right base. The patient signed the IRB-approved consent form for the Virtual HDRsm CyberKnife Radiosurgery Monotherapy Protocol.

Sparing urethra and creating a very sharp dose gradient over the rectum – Prescription dose line is light orange

Concentrating the highest dose to match peripheral zone cancer cell distribution

NVB is partially spared from the full dose zone
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