Stereotactic Hypo-fractionated Radiotherapy for Low Risk Prostate Cancer

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Purpose

To exploit the potential advantage of hypo-fractionated radiotherapy for prostate cancer based upon its unique radiobiology. We report the toxicity and early PSA outcome for low risk prostate cancer patients.

Patients & Methods

An ongoing IRB-approved institutional program of hypo-fractionated stereotactic radiotherapy began in 12/03. Eligibility criteria are stage T1c-T2b, PSA <10, Gleason 3+3 or 3+4, with <50% of biopsy cores positive. The CyberKnife (Accuray, Inc.) was used to deliver 5 daily fractions of 725cGy (total 3625cGy). Image-guidance is achieved with fiducials. PTV margins are 3mm posterior and 5mm elsewhere. Patients are followed every 3 months with PSA, IPSS and EPIC questionnaires.

Patient Characteristics

Median Follow-up	18.9 mo (0 - 27.1)
Median Age	66 yrs (48 - 82)
Median initial PSA	5.6ng/mL (.7 - 12.2)
Gleason Score:	
3+3	23 pts
3+4	10 pts
Clinical Stage:	
T1c	22 pts
T2a	10 pts
T2b	1 pt
Median US Volume	34.5cc (19.2 - 69.1)

Radiation Treatment Statistics

Factor	Mean	Range
Prostate CT Volume	59.8cc	32.8 - 102.4
PTV Volume	94.2cc	65.1 - 146.4
Max Dose in PTV	4162cGy	3898 - 4889
Max Rectal Dose	3957cGy	3674 - 4792
Max Bladder Dose	4007cGy	3801 - 4889
Max Femoral Head Dose	1702cGy	974 – 2410
Rectal V_{100}	2.4cc	0 - 6.9
Bladder V_{100}	9.4cc	1.3 - 113.2

A high degree of caution is given to normal tissue tolerances with hypo-fractionation and especially to the rectum. Dose is prescribed to cover 95% of the PTV and is optimized for rectal sparing. A representative DVH is shown in Figure 1.

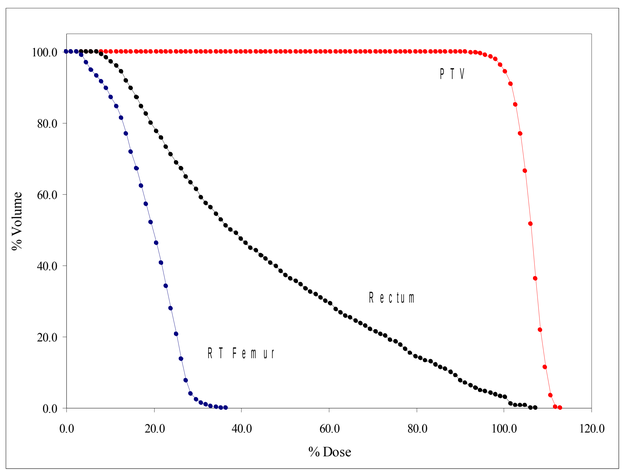

Figure 1: Representative DVH

Acute & Late Toxicity on the RTOG grade scale

Stereotactic Hypo-fractionation for Prostate				
RTOG	**Grade 1**	**Grade 2**	**Grade 3**	**Grade 4**
Acute ≤ 90 days (pts)				
Bladder	2	1	0	0
Rectum	7	1	0	0
Late >90 days (pts)				
Bladder	12	1	1	0
Rectum	15	2	0	0
MDACC Prostate Dose Escalation Trial: 78Gy Arm				
Bladder	22%	10%	3%	0%
expected no. pts*	7	3	1	0
Rectum	28%	19%	7%	0%
expected no. pts*	9	6	2	0

*expected no. pts = MDACC rate of toxicity (%) * 33 pts

Results

33 patients were treated. Median normalized PSA declined to 0.12 at 18 months (Figure 2). PSA bounce was observed in 2 patients so far.
Early/Late bladder and rectal toxicities are shown. Comparisons are made with the 78Gy 3DCRT arm from the MDACC dose escalation trial. There were no acute or late RTOG grade 4 bladder/rectal toxicities.

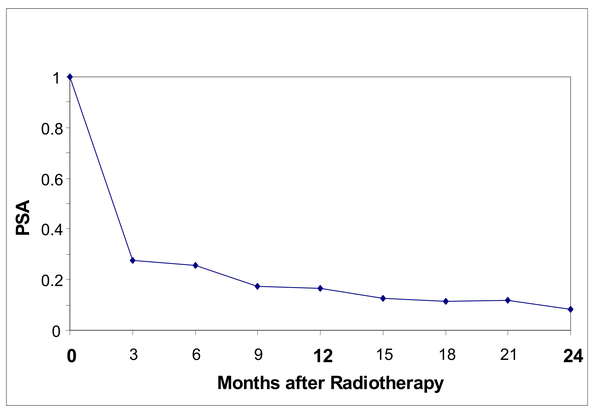

Figure 2: Median Normalized PSA

Conclusions

Hypo-fractionated stereotactic radiotherapy for low risk prostate cancer appears well tolerated so far. Early PSA results are encouraging. Much longer follow up and many more patients are needed to confirm the long term safety and effectiveness of this approach.