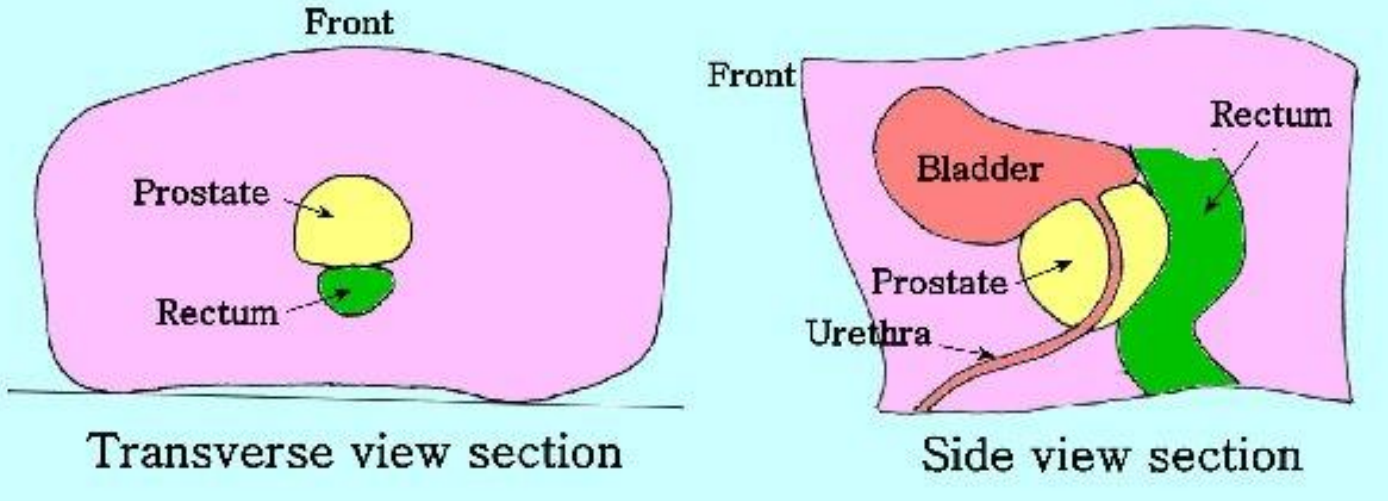


MEDANTA RADIOSURGERY

Stereotactic Robotic Body Radiotherapy for Carcinoma Prostate

Tejinder Kataria,
Medanta Cancer Institute
Gurgaon, India

Hypofractionation works for Prostate



BIOLOGY CONTRIBUTION

FRACTIONATION AND PROTRACTION FOR RADIOTHERAPY OF PROSTATE CARCINOMA

DAVID J. BRENNER, D.Sc.,* AND ERIC J. HALL, D.Sc.*

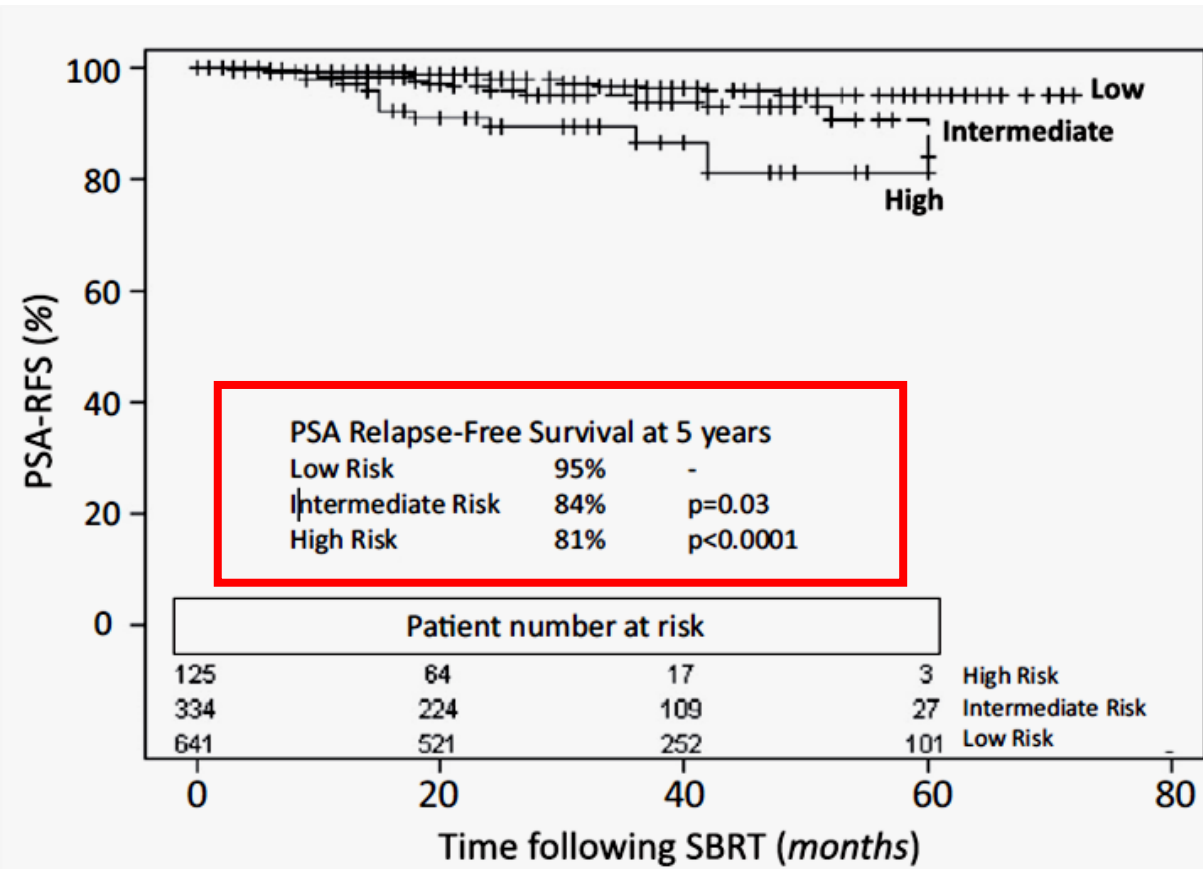
Center for Radiological Research, Department of Radiation Oncology, Columbia University, New York, NY

- Fowler J. $\alpha/\beta = 1.5$ (1.2-1.8)- IJROBP. 2001
- Brenner et al $\alpha/\beta = 1.2$ (.03-4.1). IJROBP. 2002.
- King , Fowler-**1.8- 2.8** IJROBP.2001;51:213-214
- W D' souza. **Low**. IJROBP2001;51:1-3
- Dale, Jones- **1**
- Kupelian concluded **low α/β** .

Unusually low α/β (~ 1.5), lesser than that of surrounding critical structures

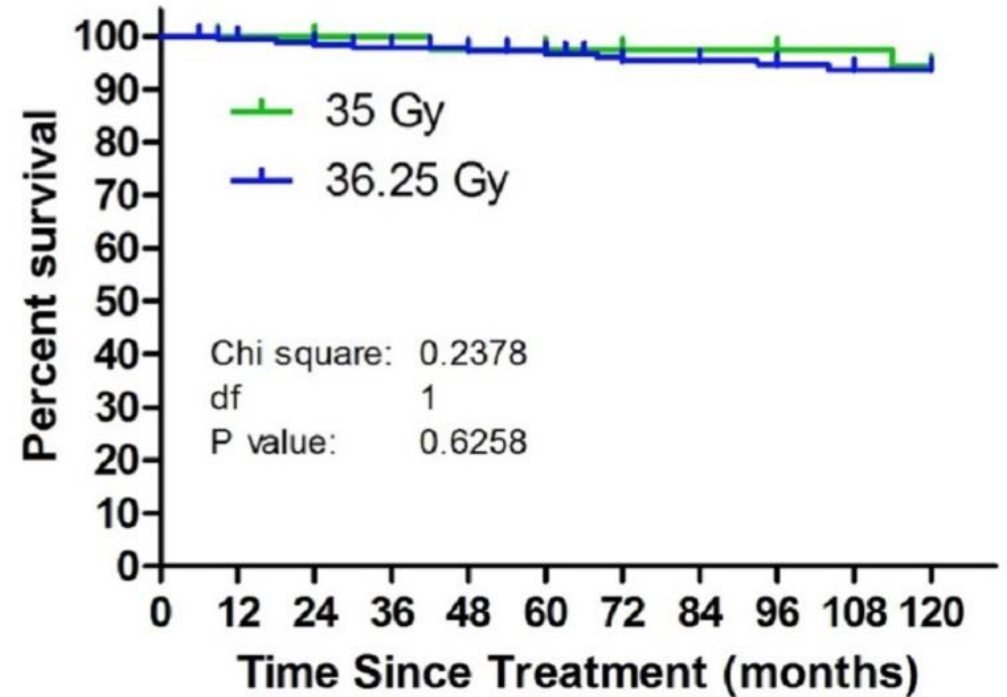
Aims to exploit the **differential sensitivity** of tissues with different α/β ratio to radiation

SBRT- Results



C.R. King et al. / Radiotherapy and Oncology 109 (2013)

Biochemical Disease Free Survival



Stereotactic Body Radiotherapy for Low-Risk Prostate Cancer: A Ten-Year Analysis

Alan Katz ¹

Stereotactic body radiation therapy for prostate cancer—a review

Waqar Haque¹, E. Brian Butler², Bin S. Teh² Chin Clin Oncol 2017;6(Suppl 2):S10

Table 2 Photon-based stereotactic body radiation therapy in conjunction with external beam radiation therapy for localized prostate cancer

Study	Number of patients	Study type	Median follow up time (months)	Dose and fractionation	Actuarial FFBF	RTOG/CTCAE late GI toxicity ≥ grade 3 (%)	RTOG/CTCAE late GU toxicity ≥ grade 3 (%)
Mercado <i>et al.</i> (46)	108 (4 L, 45 I, 59 H)	Retrospective	41	19.5 Gy in 3 fx (SBRT) and 45–50.4 Gy in 35–28 fx (CF-EBRT)	3 years: 100% I, 89.8% H	NR	NR
Katz <i>et al.</i> (47)	73 (41 I, 32 H)	Retrospective	33	18–21 Gy in 3 fx (SBRT) and 45 Gy in 25 fx (CF-EBRT)	3 years: 89.5% I, 77.7% H	0	1.40
Anwar <i>et al.</i> (48)	48 (14 I, 34 H)	Retrospective	42.7	19–21 Gy in 2 fx (SBRT) and 45 Gy in 25 fx (CF-EBRT)	5 years: 90%	0	1
Lin <i>et al.</i> (49)	41 (H)	Retrospective	42	21 Gy in 3 fx (SBRT) and 45 Gy in 25 fx (CF-EBRT)	4 years: 91.9%	0	0
Kim <i>et al.</i> (50)	39 (20 I, 19 H)	Retrospective	53.6	21 Gy in 3 fx (SBRT) and 45 Gy in 25 fx (CF-EBRT)	5 years: 100% I, 89.5% H	0	0

Data regarding the use of a prostate stereotactic body radiation therapy boost along with conventionally fractionated radiation therapy for the management of prostate cancer. L, low-risk prostate cancer; I, intermediate-risk prostate cancer; H, high-risk prostate cancer; Gy, Gray; fx, fractions; NR, not reported; RTOG, Radiation Therapy Oncology Group; CTCAE, Common Terminology Criteria for Adverse Events; GI, gastrointestinal; GU, genitourinary.

Objective

- In patients of carcinoma prostate who received Radical Prostate SBRT with Cyberknife VSI between 2013- 2019
 - Biochemical control
 - Radiological control
 - Toxicity

Material and Methods

- Data from the electronic medical record was retrieved with IRB permission
- Patients treated with radical intent were included in the analysis.
 - Radical CK SBRT. Or Reverse Boost CK followed by WPRT
- All patients were treated under institutional CyberKnife (CK) protocol
- MRI was mandatory. PSMA PETCT after May, 2017.

Target Delineation:

CTV

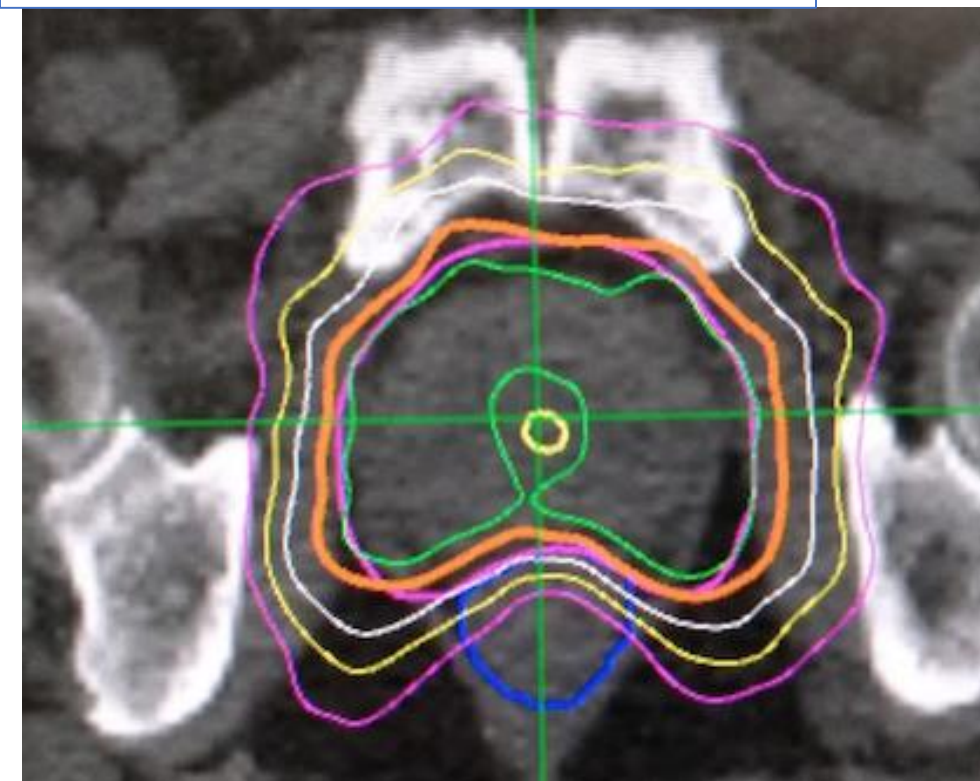
T1-T2: Prostate only

T3: Prostate+ 1cm of Proximal SV

PTV: 5mm all around except
posterior(3mm)

OAR:

Urethra , Bladder, Rectum, Femur Head



- Rectal dose reduction
 - V36 Gy < 1 cc (5 Fx)
 - V40Gy <1cc (7 Fx)
 - < 20% receiving 80% of dose
 - < 50% receiving 50% of dose
 - <90% receiving 10% of dose
- Bladder neck dose reduction:
 - V37 Gy < 10 cc
 - D5% <40Gy
- Prostatic urethra dose reduction
 - Dmax prostatic- < 105%

RADIOLOGICAL RESPONSE

Parameter	No response	Response
Prostate volume	Increase / Same	Reduction
T2 hypointensity	No change	Diffuse or loss in hypointensity
Diffusion Restriction on DWI	No change	Mild or NO restriction
Choline peaks on MRS	Persistent	Decreased/absent
Perfusion	Persistent	Decreased/absent
PSMA-PET	Persistent avidity	Reduction or No avidity

Real time imaging & correction

Medical ID: MM00532621
Plan Name: AM_7GyX7F_Prost
Anatomy: body
Path Set: prostate_intempo
Path Number: 1
Orientation: HFS
Collimator: Variable Iris

DRR Live Overlay Corrections

Correlation Error
Tracking Mode
Fiducial

Imaging Parameters
Treatment Monitoring

XRS A | kv: 120 mA: 100 EX: 100 | XRS B | kv: 120 mA: 100 EX: 100

WINDOW 65535
LEVEL 65535

View Mode X-Hairs Zoom Auto

Fiducial Tracking
Fiducial 1
Fiducial 2
Fiducial 3
Fiducial 4
Rigid Body Error = Unknown

Patient Size Large

Medical ID: MM00532621
Plan Name: AM_7GyX7F_Prost
Anatomy: body
Path Set: prostate_intempo
Path Number: 1
Orientation: HFS
Collimator: Variable Iris

DRR Live Overlay Corrections

Corrections
LFR: 3.5 mm
ANT: 27.7 mm
SUP: 22.2 mm
RGT: 2.5 deg
H-DWN: 7.4 deg
CCW: 3.1 deg
Correlation Error
Tracking Mode
Fiducial

Imaging Parameters
Treatment Monitoring

XRS A | kv: 120 mA: 100 EX: 100 | XRS B | kv: 120 mA: 100 EX: 100

WINDOW 65535
LEVEL 61728

View Mode X-Hairs Zoom Auto

Fiducial Tracking
Fiducial 1
Fiducial 2
Fiducial 3
Fiducial 4
Rigid Body Error = 1.08 mm

Patient Size Large

Results

Study duration	March 2013- Jan 2019
No of patients	N=70
Age (median, Range)	70 (54-86 yrs)
Comorbidities	82% (57/70)
Treatment groups: CK alone	32/70(45.7%)
CK Boost+ WPRT	38/70(54.3%)
Risk Group: Low Risk	2/70(<3%)
Intermediate	17/70(20.4%)
High	21/70(30%)
Very High	20/70(28.6%)
Node positive	10/70(14.3%)
Dose (BED)	210 (mean 207Gy;range 151-277).
Dose: CK alone	35Gy- 42Gy in 5-7 Fx
CK Boost	18Gy-21Gy in 3 Fx

Follow up (Median, Range)	32.4 (6-60mth)
PSA relapse free survival(median ,range)	30 months (5-78mth)
PSA nadir value (Median, Range)	0.01 ng/ml (0 - 1.03 ng/ml)
local radiological relapse free survival	32 months (5-78mth).

Parameter	Radical CK	CK Boost
Grade III bladder toxicity	0 acute 0 late	0 acute 1 late
Grade III rectal toxicity	0 acute 0 late	1 acute 0 late

Conclusion

- A large proportion of our patients had high-risk features (73%) however, compared to published literature, favourable results were achieved.
- SBRT alone or in combination with WPRT was very well tolerated with minimal Toxicity.

Thank you!