Supplementary material for Kole TP, et al. A dosimetric comparison of ultra-hypofractionated passively scattered proton radiotherapy and stereotactic body radiotherapy (SBRT) in the definitive treatment of localized prostate cancer. *Acta Oncol* 2015;54:825–31.

Supplementary Appendix

Normal tissue complication probability

Normal tissue complication probability for the rectum was calculated using the Lyman Kutcher Berman (LKB) model as previously described [1–5]. The Lyman parameters TD50, m, and n were obtained for late $\geq$ grade 2 rectal toxicity from the recent QUANTEC best estimate by Michalski et al. [6]. Rectal DVHs were first converted to an equivalent dose based on 1.8-Gy fractions using the linear quadratic (LQ) model and a normal tissue α/β ratio of 3 Gy for late radiation effects. Converted DVHs were then histogram-reduced and the effective volume was calculated as:

$$V_{eff} = \sum v_i \left(\frac{D_i}{D_{max}} \right)^{1/n}$$

where D_i is the dose of the volume bin v_i of the differential DVH. The partial volume tolerance dose was then calculated as:

$$TD50(V) = \frac{TD50}{V^n}$$

and the NTCP was then defined by the following:

$$NTCP = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^u e^{-t^2/2} dt$$

where

$$u = \frac{D_{max} - TD50(V)}{m \times TD50(V)}$$

References

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Supplementary Table I. Target doses and normal tissue tolerances according to the Radiation Therapy Oncology Group 0938 protocol guidelines.

OAR/target	Index	Objective	Cyberknife	Proton
PTV	V 36.25 Gy/CGE	> 95%	95.8%	95.0%
	V 34.44 Gy/CGE	> 99%	99.1%	99.7%
	V 43.5 Gy/CGE	< 0.03 cm ³	0.01 cm ³	0 cm ³
Prostatic urethra	V 36.25 Gy/CGE	> 95%	99.0%	99.7%
	V 38.78 Gy/CGE	< 0.03 cm ³	0.0035 cm ³	0.0006 cm ³
Rectum	V 38 Gy/CGE	< 1 cm ³	0.12 cm ³	0 cm ³
	V 34.44 Gy/CGE	< 3 cm ³	1.74 cm ³	2.19 cm ³
Bladder	V 38 Gy/CGE	< 1 cm ³	0.74 cm ³	0.06 cm ³
Penile bulb	V 30.25 Gy/CGE	< 0.03 cm ³	0 cm ³	0 cm ³
	V 20 Gy/CGE	< 3 cm ³	1.58 cm ³	0.55 cm ³
Membranous urethra	V 37 Gy/CGE	< 50%	31.6%	6.51%
Right femoral head	V 14.5 Gy/CGE	< 5%	0.61%	0.21%
Left femoral head	V 14.5 Gy/CGE	< 5%	0.08%	0.16%

OAR, organ at risk; PTV, planning target volume.

Supplementary Table II. Complete comparative dose-volume indices.

OAR/target	Dosimetric index	Cyberknife	Proton	p-Value
PTV	V10%	100%	100%	1
	V25%	100%	100%	1
	V50%	100%	100%	1
	V75%	100%	100%	1
	V90%	99.8%	99.99%	0.002
	V100%	95.9%	95%	0.006
	V105%	78.99%	21.57%	0.002
	Mean dose (Gy/CGE)	39.6	37.6	0.002
Prostatic urethra	V10%	100%	100%	1
	V25%	100%	100%	1
	V50%	100%	100%	1
	V75%	100%	100%	1
	V90%	100%	100%	1
	V100%	98.96%	99.93%	0.13
	V105%	14.85%	30.72%	0.11
	Mean dose (Gy/CGE)	37.6	37.9	0.014
Rectum	V10%	82.35%	45.73%	0.002
	V25%	38.88%	21.13%	0.002
	V50%	18.83%	13.49%	0.006
	V75%	8.54%	7.99%	0.77
	V90%	3.63%	4.37%	0.23
	V100%	0.79%	1.09%	0.22
	V105%	0.14%	0%	0.031
	Mean dose (Gy/CGE)	10.6	6.66	0.002
Bladder	V10%	96.32%	59.52%	0.002
	V25%	73.02%	49.32%	0.004
	V50%	29.66%	37.4%	0.037
	V75%	13.44%	25.33%	0.004
	V90%	7.14%	15.86%	0.004
	V100%	3.0%	5.82%	0.037
	V105%	0.96%	0.02%	0.002
	Mean dose (Gy/CGE)	15.4	13.7	0.56
Penile bulb	V10%	81.35%	37.80%	0.002
	V25%	55.33%	22.72%	0.002
	V50%	20.19%	8.61%	0.004
	V75%	3.66%	0.69%	0.031
	V90%	0.04%	0%	1
	V100%	0%	0%	1
	V105%	0%	0%	1
	Mean dose (Gy/CGE)	11.4	5.19	0.002
Membranous urethra	V10%	100%	99.96%	1
	V25%	100%	98.64%	1
	V50%	98.98%	96.19%	0.5
	V75%	92.61%	86.99%	0.078
	V90%	75.93%	64.13%	0.027
	V100%	45.91%	21.0%	0.004
	V105%	9.23%	0.13%	0.004
	Mean dose (Gy/CGE)	34.4	32.2	0.006
Right femoral head	V10%	43.5%	86.92%	0.002
	V25%	3.79%	80.69%	0.002
	V50%	0%	0%	1
	V75%	0%	0%	1
	V90%	0%	0%	1
	V100%	0%	0%	1
	V105%	0%	0%	1
	Mean dose (Gy/CGE)	7.12	10.4	0.002
Left femoral head	V10%	82.81%	82.31%	0.77
	V25%	28.27%	76.32%	0.002
	V50%	0%	0%	1
	V75%	0%	0%	1
	V90%	0%	0%	1
	V100%	0%	0%	1
	V105%	0%	0%	1
	Mean dose (Gy/CGE)	4.0	10.9	0.002

OAR, organ at risk; PTV, planning target volume.