

Dosimetric Advantages of Partial Prostate SBRT Compared to Whole-Gland SBRT

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INTRODUCTION

Our institution has previously reported the feasibility and tolerability of a multiparametric MRI (mpMRI)-directed, targeted partial gland radiotherapy technique using focal SBRT (f-SBRT) in patients with a single focus of low-intermediate risk prostate cancer. We hypothesize that irradiation of the primary lesion alone will allow for better organ-at-risk (OAR) sparing with comparable clinical outcomes.

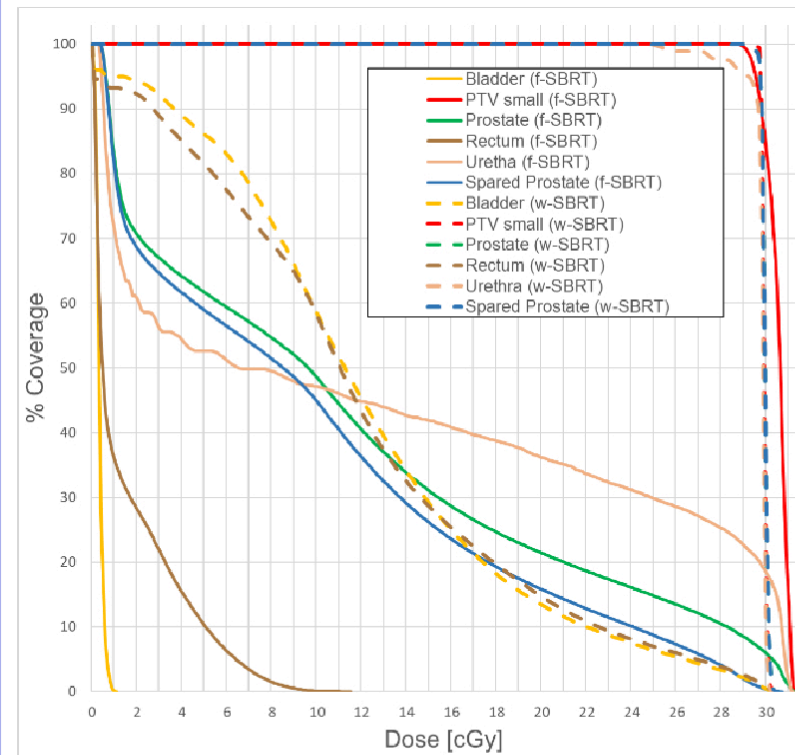
AIM

In the current study, we report a dosimetric comparison of f-SBRT with standard whole-gland SBRT (w-SBRT) plans in patients treated as per our institutional protocol.

METHOD

- Three patients with prostate cancer treated with f-SBRT after confirming the primary lesion using mpMRI and histopathology were analyzed.
- 3-4 fiducials are placed in the confirmed lesion part (i.e. in GTV) of the prostate and the physician uses both the fiducials and the MRI to create the treatment target volume. (5mm expansion except for the rectum which is a 3mm expansion).
- Each case was re-planned to receive the same dose scheme (2925 cGy at 975cGy/fractionx3fractions) for whole-gland SBRT (w-SBRT).
- The prostate-SBRT plan was designed so that it met the PROTOQOL objectives used for the prostate SBRT.
- A comparison was made of percent volumes relative to their completed f-SBRT plans.
- The w-SBRT plans are normalized such that 95% of the whole prostate PTV receives prescription dose.
- We analyzed the dose to each OAR by comparison of the V30%, V50%, V70%, and V90%.

RESULTS



DVH of a typical patient case (solid lines for focal/partial prostate SBRT (f-SBRT) plan, dash lines for whole-gland SBRT (w-SBRT) plan.

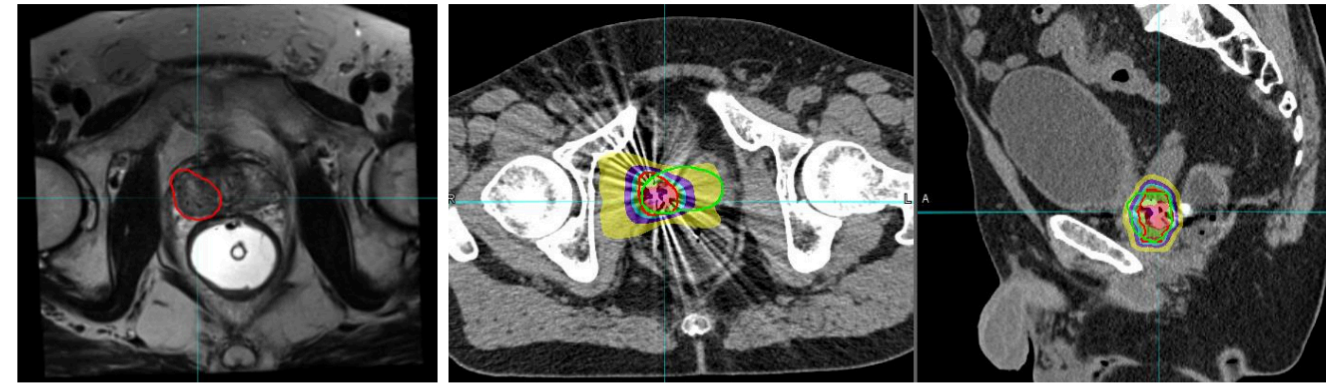


Image on the left is an MRI demonstrating a partial cancerous prostate and the image on the right is the resulting f-SBRT plan to the lesion in the prostate. The red contour is the PTV and the green contour is the whole prostate.

Average coverage of OARs while using w-SBRT or f-SBRT.

Plan	Whole Prostate SBRT (w-SBRT)				Focal/partial SBRT (f-SBRT)			
Isodose line volume	30%	50%	70%	90%	30%	50%	70%	90%
Bladder	43.4%	23.3%	10.9%	4.78%	0.03%	0.0%	0.0%	0.0%
Prostate	100.0%	100.0%	100.0%	100.0%	70.2%	57.3%	39.7%	26.2%
Rectum	70.7%	37.8%	16.6%	5.7%	15.7%	5.1%	1.6%	0.5%
urethra	100.0%	100.0%	100.0%	99.6%	70.9%	64.4%	40.2%	18.5%
Spared Prostate	100.0%	100.0%	100.0%	100.0%	67.0%	52.5%	31.1%	14.6%

The f-SBRT plan spares more volume of OARs than the corresponding w-SBRT plan. Averaging over all planned patients, the f-SBRT plans meet the constraints set by IRB approved protocol CASE-11813, and the w-SBRT plans meet all the volumetric constraints to OARs. When comparing the mean V50% between w-SBRT and f-SBRT plans, the f-SBRT plans spared 23% more of the bladder, 32% of the rectum, 35% of the urethra, and 47% of the rest of the prostate at the 50% isodose level (IDL). Similar benefits were observed at all analyzed IDLs across all OARs

CONCLUSIONS

This study reveals that prostate f-SBRT dosimetrically outperforms w-SBRT in the sparing of OARs. Therefore, f-SBRT is expected to yield improved clinical outcomes, especially reduced toxicity and improved quality of life, for appropriately selected patients. Longer-term follow-up and additional study in a larger cohort is warranted.

REFERENCES

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