



The Rectal Dosimetric Effects of Perirectal Hydrogel Spacers in Men Undergoing Prostate Stereotactic Body Radiation Therapy (SBRT)

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Introduction

The use of perirectal hydrogel spacers has been shown to improve the rectal dose in prostate cancer (PCa) patients treated with intensity modulated radiation therapy. This retrospective study sought to evaluate the dosimetric effects of perirectal hydrogel spacers in men with PCa treated with SBRT.

Materials and Methods

20 men (10 with perirectal hydrogel spacers and 10 without) with low or intermediate PCa and similar prostate volumes were treated with definitive SBRT (CyberKnife[®]) to 36.25 Gy in 5 fractions using fiducial tracking and a homogeneous dose distribution technique from October 2016 to January 2017 by the same treatment team. The perirectal hydrogel spacers were placed using an aseptic transperineal technique at the time of fiducial marker placement seven days prior to the treatment planning simulation. The perirectal space was defined as the distance between the posterior prostatic capsule and the anterior rectal wall on axial cuts of T2-weighted MRIs at mid-gland. The planning treatment volume (PTV) included the prostate and seminal vesicles. Rectal dose volume histogram (DVH) data was calculated using MultiPlan. The evaluated target rectal dose constraints were V18.125 <50%, V29 <20%, V32.625 <10%, V36.25 <5%, and V36 <1cc. A Student's T-test was performed to determine any significant differences between the rectal DVH data.

Patient, Tumor, and Treatment Characteristics

	With Spacer n=10	Without Spacer n=10
Age (years)		
Mean	64	62
Median (range)	62 (55-72)	63 (47-73)
Prostate Volume (cc)		
Mean	56	53
Median (range)	49 (40-88)	54 (37-64)
Gleason score		
6	2	2
7	8	8
T-stage		
T1c - T2a	10	10
T2b - T2c	0	0
Risk Group		
Low	2	2
Intermediate	8	8
Time from spacer implant to simulation (days)		
Mean	10.4	
Median (Range)	7 (7-19)	
Time from spacer implant to RT start (days)		
Mean	23.4	
Median (Range)	22 (17-33)	
Perirectal Space (mm)		
Mean	11.4	
Median (Range)	11.2 (7.1-16.4)	

Results

The median age and prostate volume of patients with and without perirectal hydrogel spacers was 62 and 63 years and 49 and 54 cc, respectively. The mean perirectal distance in the spacer group was 11.4 ± 2.9 mm. The mean rectal V29 was reduced from 13% to 7.6% (p=0.013), V32.625 from 6.4% to 3.4% (p=0.009), and V36 from 0.80 cc to 0.42 cc (p=0.01) between the non-spacer and spacer group. Although there was a reduction in the mean rectal V18.125 from 38.4% to 31.1% and V36.25 from 0.68% to 0.45%, these differences did not prove to be statistically significant. The mean prostate V40 significantly improved from 90.8% to 98.6% (p=0.001); there was no difference in the PTV V36.25.

Table 1: DVH data in PCa patients treated with definitive SBRT with and without perirectal hydrogel spacers.

	Rectal V18.125 (< 50%)	Rectal V29 (< 20%)	Rectal V32.625 (< 10%)	Rectal V36.25 (< 5%)	Rectal V36 (< 1cc)	PTV V36.25 (%)	Prostate V40 (%)
WITH SPACER							
Mean	31.09	7.63	3.39	0.45	0.45	97.57	98.56
Median	32.65	8.4	3.15	0.45	0.55	98.75	99.55
Std. Dev	10.72	4.01	2.15	0.39	0.34	2.71	2.72
WITHOUT SPACER							
Mean	38.4	12.99	6.43	0.68	0.7956	95.11	90.78
Median	37.65	13.15	6.6	0.6	0.7925	96.65	92.4
Std. Dev	7.46	4.21	2.27	0.19	0.12	3.40	5.43
p value	0.11	0.013*	0.009*	0.127	0.01*	0.107	0.001*

Figure 1: Mid gland axial view of T2 weighted MRI of the prostate after perirectal hydrogel spacer placement.

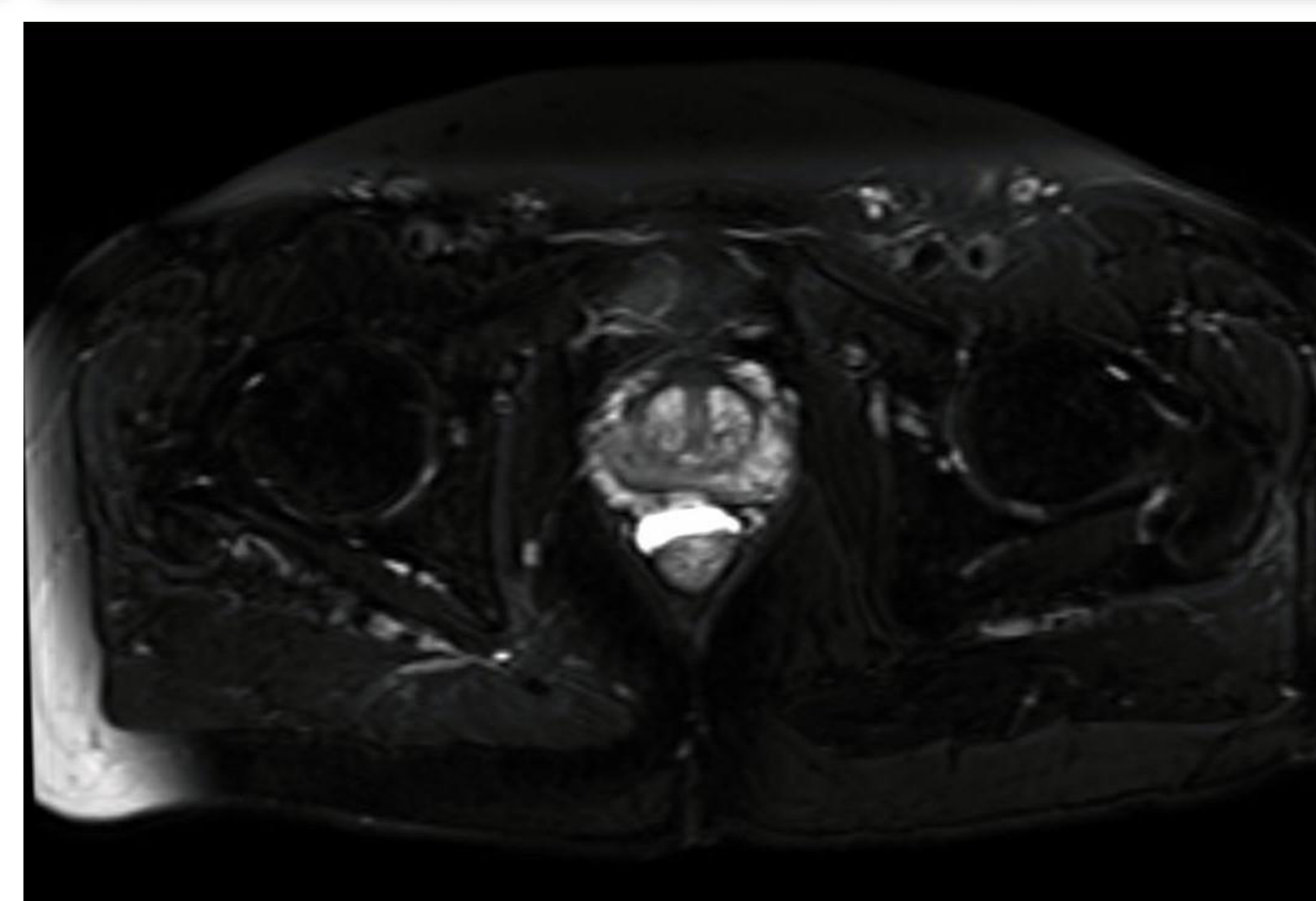
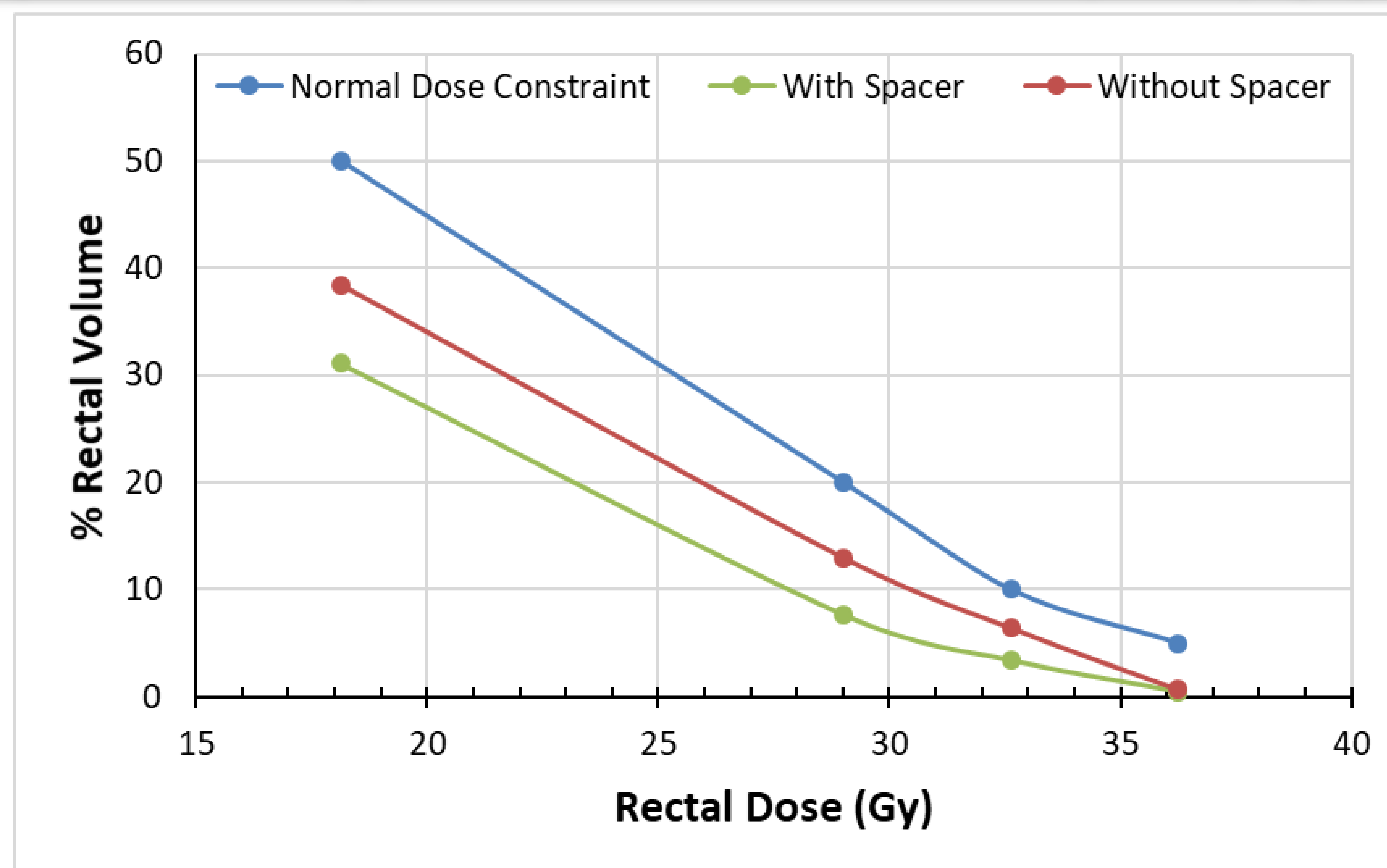


Figure 2: Rectal DVH in PCa patients treated with definitive SBRT with and without perirectal hydrogel spacers.



Conclusion

In this single institution limited retrospective study of PCa patients treated with SBRT, the use of perirectal hydrogel spacers resulted in meaningful rectal dose reductions and increased PTV coverage. Further studies with a greater sample size and longer follow up are warranted to determine the impact on acute and late rectal toxicity.