

Intensity Modulated Proton Therapy (IMPT) for Localized Prostate Cancer With or Without Trans-perineal Injection of Hydrogel Spacer

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Purpose: To date, Provision Center for Proton Therapy has treated >150 patients with prostate cancer using intensity modulated proton therapy (IMPT) technique. The purpose of this study is to assess the dosimetric impact of hydrogel spacer injection between prostate and rectum to reduce rectal dose with IMPT.

Methods and Materials: Ten patients with localized prostate cancer underwent planning CT and MRI scan before and after trans-perineal injection of hydrogel rectal spacer (SpaceOAR). Treatment plans were generated for this comparison study using Raystation planning system to deliver a dose of 78 Gy_(RBE) in 39 fractions using lateral opposed fields treated daily with fiducial based image-guided IMPT technique currently practiced at our institution. Planning target volume (PTV) defined as prostate + 4mm (3 mm posteriorly) and organs at risk (OARs) dose-volume histograms were calculated. Dosimetric indices were compared between each patient planned pre and post-spacer injection using Wilcoxon signed rank test.

Results: Pre and post-spacer plans showed an 85.3% reduction in mean rectal V70 Gy_(RBE) (4.62% to 0.68%, p < 0.001) with spacer injection. Pre-spacer mean rectum V75, V60, V50 and V30 Gy_(RBE) were 2.59%, 8.05%, 11.2% and 18.3% compared to post-spacer 0.26%, 1.74%, 3.36% and 8.5%, respectively (p < 0.001). All treatment plans with and without spacer met dose coverage goal of ≥ 98% of PTV receiving 78 Gy_(RBE). Pre-spacer mean PTV78 Gy_(RBE), PTVD₉₉ and PTVD₁ were 98.4%, 77.7 and 79.5 Gy_(RBE) compared to post-spacer 98.5%, 77.8 and 79.5 Gy_(RBE), respectively (p = ns). Pre-spacer mean bladder V78, V70 and V45 were of 2.6%, 6.6% and 14.7% compared to post-spacer 2.5%, 5.7% and 11.9%, respectively (p = ns).

Conclusions: Hydrogel spacer injection significantly decreased rectal dose in patients planned using intensity modulated proton therapy (IMPT) when compared to plans without rectal spacer. The rectal dose sparing benefit provided by spacer utilization remained highly significant in even in the higher dose range of V60 to V78 Gy_(RBE), without any compromise in target coverage or bladder dose sparing.

Dose Distribution:

