

AbstractID: 13041 Title: Evaluation of Prostate Volume Change in Tumor Control for LDR Brachytherapy

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Purpose: This study evaluates low dose-rate brachytherapy (LDR) prostate plans to determine the biological effect of dose degradation due to prostate volume changes after the implant procedure.

Methods and Materials: In this study, 39 prostate cancer patients were evaluated. Ultrasound was performed to determine the pre-implant prostate volume. These images were used with Nucletron Spot pro 3.1 treatment planning system to create a treatment plans using Pd-103 seeds. On the day of the procedure, after the implant, the patients were imaged using CT for post-implant dosimetry. The prostate volumes from the pre and post implant image sets were measured. For the pre and post-implant DVH, the biologically equivalent dose and the tumor control probability was determined using BEUD. The BEUD model used $RBE = 1.75$ and $\alpha/\beta = 4$ Gy.

Results: The prostate volume change between pre and post implant image sets ranged from -8% to 264%. Tumor control probability and the BEUD were reduced up to 80% and 56% respectively. As expected, the tumor control is observed to decrease as the mean dose to the prostate decreases. The post-implant tumor dose was generally seen to decrease compared to the planned dose. This corresponded to a lower BEUD and a lower tumor control probability. However, there was no correlation between the degree of prostate enlargement and the degradation of tumor dose or tumor control.

Conclusions: The biological effect of prostate growth in LDR was evaluated using BEUD. The post-implant dose was lower than the planned dose due to an increase of prostate volume post-implant. However, the magnitude of prostate growth was not correlated to the degree of dose degradation. Although the dose is seen to decrease post-implant, BEUD indicates that tumor control is not significantly reduced.