AbstractID: 4551 Title: Multiobjective inverse planning optimization: adjustment of dose homogeneity and urethra protection in HDR-Brachytherapy of the prostate

Purpose: Multiobjective optimizations are performed to evaluate the inverse planning (IP) ability to adjust the dose homogeneity and the urethra protection in HDR brachytherapy of the prostate.

Materials and Methods: An IP is an anatomy-based optimization guided by dose objectives specified for each organ extracted from medical imaging. It selects automatically the active dwell positions and optimizes the dwell times to fulfill the dose objectives. It is setup to maximize the prostate dose coverage while taking into account other clinical objectives like the dose homogeneity and the organs at risk protection. Multiobjective optimizations are performed using the IP for one small (23cc), one intermediate (35cc) and one large (80cc) prostate. 10 inverse plans were generated with different compromises between dose coverage and dose homogeneity. This was performed first with the prostate alone and then with all the organs at risk. In addition, 10 inverse plans were generated with different compromises between dose coverage and urethra protection. 90 DVH were generated and analyzed.

Results: When only the prostate is included, the prostate V100 varies from 100% to 97% and the homogeneity index (HI) from 0.06 to 0.68. When all the organs at risk are included, the prostate V100 varies from 97% to 91% and the HI from 0.52 to 0.72. When the urethra protection is increased, the prostate V100 varies from 100% to 89%, the urethra V100 from 100% to 89%, the urethra V120 from 87% to 0% and the urethra V150 from 3% to 0%.

Conclusion: For simple cases where only a target is defined, the dose homogeneity is adjustable with the IP. For complex cases where organs at risk are added, this anatomy-based optimization automatically adjusts the dose homogeneity to protect the urethra. Additional organ protection can be achieved with specific penalty.

This research was supported by Nucletron Corporation.