AbstractID: 8960 Title: Is a Volume-Based HDR Brachytherapy Optimization Algorithm Comparable to a Classic Line-Based One?: Toward Tumor-Volume Adaptive Brachytherapy for Cervical Cancer By 3T MRI Guidance

Purpose: Verify a volume-based optimization algorithm against a classic line-based one for intracavitary high-dose-rate (HDR) brachytherapy (BT) treatment planning for cervical cancer.

Methods and Materials: This retrospective study reviewed ten randomly selected tandem and ovoids plans. To investigate the dose-behavior induced by different algorithms, no variations in T&O applicator geometry and imaging dataset were made. Three metrics were employed: 1) the total reference air kerma (TRAK), 2) the volume enclosed by the 100% prescription dose ($VOL_{100\%Rx}$) (both based on ICRU Report 38), and 3) the dose to Point H. Conventional HDR plans (BrachyVision^{TM}, Varian, version 6.1) were regenerated and reoptimized by the optimization algorithm capable of incorporating a volume-based optimization (version 6.5). To optimize dwell times, both are based on Nelder-Mead Simplex method. However, a volume-based plan optimizes dwell times to give the desired dose to volumetric structures along with reference lines by utilizing a group of points in a structure, while a conventional algorithm affords solely reference lines.

Results: A volume-based algorithm was found to be comparable to a classic one in terms of three metrics described above. The ratio of TRAK values (i.e. a volume-based algorithm over a classic), $VOL_{100\%Rx}$, and Point H doses showed on average 1.01 (std dev ± 0.01), 1.03 (std dev ± 0.07), and 0.99 (std dev ± 0.02), respectively. To obtain an identical HDR plan was limited. However, we found a volume-based optimization algorithm generates a plan comparable to a classic line-based one which is relatively simple and robust. The plan generated by a volume-based optimization algorithm also affords the ABS recommendations for BT for cervical cancer.

Conclusion: A high-dose-rate brachytherapy plan utilizing a volume-based optimization algorithm was comparable to a classic one. Hence, a volume-based optimization is available to be implemented for a tumor-volume adaptive brachytherapy.