AbstractID: 10408 Title: A study of effectiveness of dose volume histogram based multi-solutions optimization algorithm in high dose rate Brachytherapy for the prostate

Purpose: To investigate the effectiveness of multi-solutions dose volume histogram based optimization (MDVHO) for high dose rate (HDR) brachytherapy for the prostate.

Method and Materials: This study consists data from 20 patients who underwent ultrasound based real time HDR brachytherapy for the prostate using the treatment planning system (TPS) called Oncentra Prostate (vs. 3) by Nucletron. The treatment plans for all the patients treated were optimized using graphical optimization (GRO). The GRO is the on screen manipulation of isodose lines slice by slice manually and quality of plan heavily depends on planner expertise and experience. Later, treatment plans were created and optimized using MDVHO algorithm with same set of dose constraints, same number of catheters as in GRO. MDVHO is an anatomic based deterministic optimization algorithm. Several Pareto optimal solutions were obtained by varying the weighting factors of composite objective function in finite steps with adequate resolutions. These solutions were then stored in the database of TPS and final solution that best fulfilled the clinical goal was selected from the pool of alternative solutions using decision engine.

Results: The mean dose to 100% of planning target volume (PTV) V_{100} due to MDVHO and GRO were 95.03% and 97.56% of prescription dose respectively which was not statistically significant (P = 0.066) using student pair t-test at 5% level of significance. The mean conformal index (0.65 vs. 0.50) was statistically higher (P = 0.002) with MDVHO in comparison to GRO. The mean dose (D_{mean}) and dose to 10% volume (D_{10}) of critical structures such as urethra, bladder and rectum were comparable with MDVHO and GRO.

Conclusion: MDVHO algorithm can provide conformal plans with comparable dosimetric indexes to PTV and critical structures in comparison to GRO within clinically reasonable amount of time independent of planner experience and expertise.