

AbstractID: 6608 Title: Anatomy-Based Inverse Planning Simulated Annealing (IPSA)
Optimization in HDR Prostate Brachytherapy

Purpose: Independent validation of IPSA algorithm in obtaining superior target coverage and reduced dose to organs at risk, by comparing with the results of other optimization techniques in HDR brachytherapy.

Method and Materials: In a recent prostate HDR brachytherapy protocol study (RTOG-0321) we used an anatomy based inverse optimization technique known as Inverse Planning Simulated Annealing (IPSA), incorporated as a beta version in the Plato TPS Version 14.2.3 (Nucletron Corp., Veenendaal, The Netherlands) in an effort to satisfy the dose constraints set by the protocol for Prostate, Bladder, Rectum and Urethra. Between the period of June 2005 and November 2006, 20 patients received HDR boost dose of 19 Gy in two fractions to the prostate in addition to an external beam dose of 45 Gy with IMRT technique. 3D Brachytherapy treatment plans were generated using Plato Version 14.2.3. Dosimetry was obtained for the following optimization schemes in Plato, for the same dose constraints for all the patients treated during this time period: Anatomy based IPSA optimization, Geometric optimization on volume and Dose Point optimization on volume. Dose volume histograms were generated for PTV and organs at risk for each optimization method, from which V75 volumes for Rectum, Bladder, and V125 volume for Urethra were determined. Also dose homogeneity index as well as conformal index for the PTV was calculated for each optimization technique.

Results: Despite suboptimal needle placement in some implants, using the same dose constraints on all patients, IPSA algorithm was able to comply with the tight RTOG dose constraints for 90% of the patients in this study, whereas it was only 30 % for DPO and only 5% for GO.

Conclusion: Anatomy based IPSA optimization proved to be the overall best and fast technique for reducing the dose to organs at risk without compromising target coverage.