AbstractID: 7213 Title: HDR Brachytherapy and Online Image-Guided Adaptive IMRT for Dose Escalation in Prostate Cancer: Comparison of Brachytherapy and IMRT Boosts.

Purpose: A course of one to three large fractions of HDR interstitial brachytherapy (HIB) is an attractive alternative to intensity modulated radiation therapy (IMRT) for delivering boost dose to the prostate in combination with additional external beam irradiation for intermediate risk disease. The purpose of this work is to quantitatively compare single-fraction HIB boost to biologically equivalent fractionated IMRT, assuming idealized image-guided delivery (igIMRT) and conventional delivery (cIMRT).

Materials & Methods: For 9 prostate patients, both 7-field IMRT and HIB boosts were planned. The Linear-Quadratic model (alpha/beta = 3Gy) was used to compute biologically equivalent dose (BED) prescriptions: (a) HIB boost delivered 9Gy in a single fraction, (b) igIMRT boost delivered 20.25Gy to the CTV (prostate gland) in 9 fractions, (c) cIMRT boost delivered 20.25Gy in 9 fractions to the PTV (10mm expansion, 6mm posteriorily). The cIMRT plan was evaluated as a static plan, and with a simulated random and setup errors. The plan evaluation endpoints were: (a) for Tumor Control, the CTV Equivalent Surviving Fraction (ESD index) and (b) for Bladder and Rectum toxicity the Generalized Equivalent Uniform Dose (gEUD) and BED VH parameters.

Results: HIB delivery produces outcomes comparable to or better than the idealized igIMRT delivery. On average, the ESD is 16% higher in the HIB delivery than it is in the IMRT delivery. For the HIB, the bladder/rectal gEUD values are strongly influenced by high dose DVH tails. A saturation BED, beyond which no further injury can occur, must be assumed. The gEUD values in HIB delivery are comparable, or better, than those for the IMRT delivery. Modeling of organ motion uncertainties yields mean outcomes similar to static plan outcomes.

Conclusion: HIB offers therapeutic gains which exceed even the most optimum igIMRT.