AbstractID: 8228 Title: Radiobiological-based comparisons among conventional radiotherapy and IMRT delivery techniques for prostate treatment planning

Purpose: To apply biologically effective uniform dose (BEUD) calculation on prostate treatment plans developed using conventional radiotherapy and three IMRT techniques.

Method and Materials: Ten prostate patients were chosen to be analyzed both physically and biologically. Conventional plans were developed using the four-beam box and 3DCRT techniques for both 6MV and 18MV photon beams on Pinnacle3 treatment planning system. IMRT plans were constructed using the MLC-based step-and-shoot IMRT technique (P3 IMRT) for both photon energies on Pinnacle3 treatment planning system. Plans for helical tomotherapy (HT) and serial tomotherapy were also made using the HiArt TomoTherapy and the Corvus6.3 treatment planning systems, respectively. Doses to the targets were normalized to assure that 95% of the PTV received 76Gy. For each prostate case, radiobiological measures were applied to comprehensively evaluate the suitability of four-beam box treatment plans, 3DCRT plans and P3 IMRT plans developed using different photon beam energies. In addition, BEUD together with complication-free tumor control probability (P_+) were calculated to compare plans with different delivery modalities.

Results: 18MV photon beams delivered in conventional radiotherapy and IMRT plans, in general, resulted in higher P_+ than 6MV beams. When applying RTOG0415 dose criteria to all plans, 3DCRT plans had a higher P_+ of 37% than IMRT plans (25.8% for P3 IMRT and 29.2% for HT). By putting on stricter dose constraints to IMRT plans, higher P_+ of 38.2% for P3 IMRT and 30.5% for HT were achieved.

Conclusion: BEUD calculation provides a comprehensive evaluation on treatment plans with different delivery modalities. From results of radiobiological analysis, there were insignificantly different dose responses found between 6MV and 18MV treatment plans delivered using 3DCRT, four-beam box and P3 IMRT techniques for prostate radiotherapy. Moreover, when comparing different treatment methodologies using radiobiological measures, IMRT plans turned out not necessarily superior to conventional treatment plans