AbstractID: 9717 Title: Equivalent Uniform Dose (EUD) in IMRT and 3D Conformal Treatment Planning for Prostate: Comparison with the Lyman Model for NTCP in Bladder and Rectum

Computer inverse planning associated with intensity-modulated radiotherapy (IMRT) is frequently associated with increased dose heterogeneity compared to 3-D conformal radiotherapy, raising questions of biological effect of IMRT. To deal with inhomogeneous dose distributions in a simplified way, Niemierko has proposed a power law to compute the equivalent uniform dose (EUD), the uniform dose that would hypothetically result in the same biological effect as the actual tissue dose distribution. The concept has been extended from tumors to organs at risk (OARs), for which the biological end point is normal tissue complication probability (NTCP). A phenomenological model and associated data parameters are available in the literature for the observed sigmoid-shaped dose response of NTCPs. It is of interest to compare EUDs with calculations of NTCP for OARs rectum and bladder encountered in prostate cancer radiotherapy, for both 3-D and IMRT. Dose-volume histograms for bladder and rectum from 22 consecutive patients who were given localized-field IMRT treatment for prostate cancer to a mean dose of 74.7 Gy provided data for calculation of individual patient EUDs and NTCPs, with the EUD power-law parameter taken as the reciprocal of the Emami-Burman volume dependence parameter. Identical calculations were performed for the same patients for 3-D conformal treatment plans. A single curve accurately fits through both 3-D and IMRT data in a scatter plot of NTCP versus EUD for each OAR. Under these conditions associated with relatively low complication probability, the simplified EUD calculation provides an effective surrogate for NTCP for both IMRT and 3-D.