AbstractID: 1193 Title: A Comparison of the Efficacy of Mathematical Complication Models in Predicting Radiotherapy-Induced Cardiac Toxicity in Patients with Breast Cancer

An important factor in radiotherapy (RT) treatment planning is predicting the risk of RT-induced normal tissue complications. Research has shown, however, that not all commonly used estimators of complication probability are necessarily good models of the dose-response of specific normal tissues. This work compares the efficacy of complication models, including the widely employed Lyman normal tissue complication probability (NTCP) model and relative seriality (RS) model, in predicting left ventricular perfusion defects resulting from tangential field RT to the left breast/ chestwall. Left ventricular perfusion defects were assessed by single photon emission computed tomography scans at 6 months post-RT (68 patients, 19 with post-RT defects). The left ventricle dose-volume histograms (DVH) of all patients were used to generate the NTCP and RS models, and two other statistical discriminants: generalized equivalent uniform dose (GEUD), and linear discriminant analysis (LDA). Model parameters were optimized using Maximum Likelihood Estimation and F-tests. LDA used a combination of DVH features to optimally separate the groups with and without defects. To compare the four models, we used receiver operating characteristic (ROC) curves that plot sensitivity and specificity as a function of discriminant value. A higher ROC curve (greater area under the curve) implies a better model. The areas under the curve for NTCP, RS, GEUD, and LDA were 0.795, 0.801, 0.802, and 0.907, respectively. Statistically, LDA was the best predictor of left ventricular toxicity ($p = 0.03$). In conclusion, simple linear discriminant analysis was the best predictor, among the models studied, of RT-induced left ventricular toxicity.