Abstract ID: 16945  Title: Tumor control probability models derived using machine learning for head and neck and lung tumors including a new metric, Total Clonogen Survival (TCS)

Purpose: Empirically validated and highly predictive models of tumor control probability could help guide daily clinical practice, but are currently unavailable. Using a newly-identified dosimetric predictor (Total Clonogen Survival (described elsewhere at this meeting)), and a newly acquired dataset on head and neck tumors, we explore the predictive power available in a TCP model using machine learning methods.

Methods: We modeled two different datasets collected at Washington University School of Medicine: (A) lung cancer data consisting of 56 non-small cell carcinoma patients (a local failure group (22) and a control group (34)) who received 3D conformal radiation therapy with a median prescription dose of 70 Gy (60-84 Gy) and had a median follow-up of 32 months; (B) head and neck cancer data consisting of 80 squamous cell carcinoma patients (a local failure group (23) and a control group (57)) who received IMRT as definitive treatment with a median prescription dose of 70 Gy (66-72 Gy) and had a median follow-up of 19 months. Using dose-volume parameters extracted from these datasets, we found significant parameters for predicting local failure and evaluated the performance using support vector machines (SVM) with leave-one-out cross-validation (LOO-CV) in conjunction with several feature selection strategies.

Results: For lung cancer data, V75 and TCS were chosen as significant parameters with a Matthew's correlation coefficient (rCV) of 0.462 and a Spearman's rank correlation coefficient (RsCV) of 0.642. For head and neck cancer data, with Min dose, V70, and TCS, we achieved the best performance: rCV=0.367 and RsCV =0.554.

Conclusions: Combining the newly identified metric TCS with other relevant metrics within a machine learning framework allowed us to produce a predictive TCP model that should be further tested for potential clinical use.