AbstractID: 11636 Title: The effect of Monte Carlo-based dose calculations on tumor control probability modeling

Purpose: It has not been established whether accurate lung dosimetry really has an impact on metrics and modeling related to outcome prediction. We studied the impact of Monte Carlo-based dose calculations on TCP modeling of lung cancer tumors.

Methods and Materials: All analyzable patients treated for NSCLC between 1991 and 2001 at Washington University in St. Louis (n=56) had TCP modeled using water equivalent dosimetry and Monte-Carlo corrected dosimetry in turn. Clinical factors in the modeling included age, gender, chemotherapy, performance status, weight loss, and smoking. Dosimetric variables included Vx, Dx, maximum dose, mean dose and minimum dose covering the primary GTV. The best multivariate logistic models for both treatment planning system dose (homogeneous, uncorrected for tissue heterogeneities) and Monte-Carlo corrected dose were obtained.

Results: The best multivariate model for homogeneous dose calculations is a six-parameter model (Spearman's rank correlation coefficient, R=0.62) including V75_TCPgtvPlan, V80_TCPgtvPlan, Mindose_TCPgtvPlan, age, PreTxChemo and gtvVol. However, there was not a strong preference for specific dose-volume terms, and many models had a similar predictive power. The best multivariate model for Monte-Carlo corrected dose is a two-parameter model (R=0.527) including V75_TCPgtvMC and gtvVol, and the modeling strongly indicated that only two terms were necessary to explain the data. Interestingly, the Monte Carlo model has the superior 'face validity' while the water-based model resulted in a higher overall predictive power. The reasons for this are currently unknown.

Conclusions: Monte-Carlo corrected dose significantly impacts resulting TCP modeling, which demonstrates the need accurate modeling. Differences in the resulting models between water-based and Monte Carlo based dosimetry remain poorly understood and will require further research.

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