

AbstractID: 3718 Title: Comparison of tumor control probability and lung complication probability for lung cancer treatment with and without heterogeneity correction

**Purpose:** To compare the tumor control probability (TCP) and lung complication probability (LCP) for lung patients planned with and without heterogeneity correction.

**Method and Materials:** Twenty-one previously treated lung cancer patients were selected for the TCP and LCP comparison. The treatment plans were initially generated with a commercial treatment planning system. The dose calculations were recalculated using Monte Carlo simulations in homogenous and heterogeneous geometry rebuilt from patient CT data and using identical beam parameters. A linear quadratic model was used for the TCP analysis. A modified parallel quantal model was used for the LCP calculation. Dose volume data from the Monte Carlo results were used as input for the TCP and LCP calculations.

**Results:** Although the dose calculated for 50% of the target (D50) in heterogeneous geometry is slightly higher than the dose in homogeneous geometry, TCP with heterogeneity correction is significantly lower than that without heterogeneity correction due to the existence of cold spots. For 8 patients with similar prescription doses, the average TCP falls from 97% in homogeneous geometry to 72% in heterogeneous geometry. The LCP is similar for heterogeneous geometry and homogeneous geometry: the difference is less than 2% although the LCP is slightly higher for heterogeneous geometry because of the slightly higher dose.

**Conclusion:** The outcome for lung treatment may be compromised by inaccurate dose calculation (without the use of heterogeneity correction). Cold spots in the target volume are the major cause for the lower TCP for lung plans recalculated with heterogeneity correction. In some cases, the beam shape and/or field size can be modified to remove such cold spots. Our results suggest that heterogeneity correction is necessary for lung cancer treatment planning to ensure adequate target coverage and dose uniformity.