AbstractID: 2913 Title: From unit density to heterogeneity corrected treatment planning for lung cancer: a Monte Carlo-based dosimetric analysis of the effects on prescription dose

Purpose: Conventional radiotherapy of lung cancer assumed that the patient was composed entirely of unit-density tissues. Since biological response is correlated with actual physical dose, implementation of heterogeneity corrections should be made with caution in order to achieve the same or better clinical results. In this study we study the changes needed in prescription dose when making heterogeneity corrections.

Method and Materials: Treatment plans for 21 previously treated lung patients were regenerated using Monte Carlo with and without heterogeneity corrections. Dose volume histograms, isodose distributions and 50% target coverage (D50) were examined. Additionally, the amount of target surface abutting lung tissue and total dose delivered via oblique angles were analyzed to correlate with the actual physical dose received by the patients.

Results: The percent difference between D50 values obtained for unit-density plans and full heterogeneity corrections ranged from 0.2-8.2% and –0.1-5.0% with average values of 3.7% and 1.1% for right and left lung lesions, respectively. The difference in D50 with >50% and <50% of the target surface bounded by lung tissue ranged from 0.6-5.1% and –0.1-8.2% with average values of 3.3% and 2.0%, respectively. Differences when >35% or <35% of the dose is delivered through oblique angles ranged from –0.1-8.2% and –0.1-6.6% with average values of 3% and 1.6%, respectively. In all only 3 of 21 cases showed >5% difference in D50.

Conclusion: Our results indicate that it may not be necessary to adjust prescribed dose for lung lesions when applying heterogeneity corrections since the actual physical doses delivered to the target were as expected. Poor target coverage might be responsible for some of the local failures. Higher prescription doses may be used for lung treatment to improve local control if normal tissue sparing can be improved with advanced dose calculation and beam delivery techniques.