AbstractID: 11794 Title: Dosimetric Effects of Lung Regional Density Variation Based on 4D CT Study

Purpose: To utilize 4DCT imaging to evaluate the effect of lung regional density variation on selection of IMRT treatment technique for lung cancers.

Method and Materials: A Philips Big Bore CT scanner was used to obtain 4D CT images for 10 lung cancer patients. Two phase-specific image sets were generated for each patient, one for end- inspiration (EI) with maximum lung volume, the other for end -expiration (EE) with minimum lung volume. IMRT plans generated for each patient based on regular CT were applied to the lung volumes contoured on both EI and EE image sets. Data extracted from dose-mass histogram calculated at EE were compared to those calculated at EI. Differences in normal lung dose distribution induced by lung density variations from breathing cycle were evaluated.

Results: For all 10 patients, there were dose reductions on normal lung tissues if treatments were applied at the end of inspiration. Moreover, lung sparing was more significant if tumors were located near the apex region. Comparing the lung dose in the EI treatment with that in the EE treatment, lung mass receiving at least 20 Gy was reduced by less than 3% if the tumor was located in middle lung or base region; up to 7% if located in the apex region. The reduction was also more pronounced for large size tumors.

Conclusion: The variation of lung regional density during breathing cycle is an important factor in IMRT treatment planning of lung tumors. Higher density in the apex region exposes more lung tissues to radiation if treatments applied at the end-expiration. Deep inspiration breath-hold or gated treatment applied at the end-inspiration should be considered for treating tumor near apex region. 4D CT imaging provides a useful tool in analyzing lung density that affects dose to normal lung tissues.