AbstractID: 14295 Title: A novel method to assess the potential of pre-treatment ventilation-based functional imaging in predicting radiation pneumonitis

Purpose: Ventilation imaging has emerged as a promising form of functional imaging. Ventilation maps can be calculated from four-dimensional computed tomography (4DCT) data and provide functional lung information at no extra dosimetric or monetary cost to the patient. Before ventilation information is incorporated into thoracic treatment planning, the biological functionality needs to be investigated. Our study will develop a method to assess the potential of pre-treatment ventilation-based functional imaging in predicting radiation pneumonitis. **Methods and Materials**: For this study we used a 119 non-small-cell lung cancer patient database. Each patient had pre-treatment 4DCT imaging as part of their clinical care. The presence or absence of severe radiation pneumonitis after treatment was recorded. **Results:** Quantitative maps representing the physiologic specific ventilation were generated for four patients. For each case, a deformable image registration algorithm was used to link corresponding lung volume elements between the inhale and the exhale phase of the 4DCT dataset. Following spatial registration, corresponding Hounsfield Units were input into a density-change-based model for quantifying the local specific ventilation. The resulting ventilation images were used to linearly scale the dose to create dose function histograms. The ventilation-weighted dose values were incorporated into a Lyman NTCP model by defining an effective dose variable that consisted of a mean lung dose component and a ventilation weighted lung dose component. The accuracy of the model was statistically assessed using pneumonitis data. **Conclusion:** Our results showed that it is feasible to incorporate ventilation-based functional information into predictive radiation pneumonitis models. Ventilation images were generated for four patients. In future work, we plan to apply our method to all 119 patients in our database and test whether including functional information increases the accuracy of the predictive lung toxicity model.