AbstractID: 5371 Title: Image registration-based tool for correlation studies of radiation-induced fibrosis and local dose-related parameters in conformal non-small cell lung cancer radiation therapy

Purpose: Despite the clinical importance of radiation therapy (RT) induced pulmonary injury, methods to accurately predict the degree of RT-induced dysfunction are still lacking. Many investigators are trying to develop methods to relate dose-volumetric parameters to the risk of RT-induced lung injury, but no consensus has been reached about which of these parameters should be used. Other investigators are attempting to develop a dose-response curve for regional RT-induced damage and several local parameters like computed tomography (CT) density and single photon emission computed tomography lung perfusion and ventilation have been measured to allow an estimate of local injury.

Method and Materials: A software tool was developed for the evaluation of the correlation between RT-induced fibrosis and local dose-related parameters for a group of non-small cell lung cancer (NSCLC) patients. Local dose-related parameters were determined using both conventional and Monte Carlo (MC) dose calculations algorithms. The relation between dose, calculated on the planning CT scans and RT-induced fibrosis, identified on follow-up CT scans, was established through linear registration. Subsequently, tissues densities were determined and automatic segmentation methods were developed for lung and fibrotic tissues.

Results: One patient participating in a phase I/II NSCLC multi-center clinical trial was chosen for illustration. Patients' response to treatment was quantified by evaluating the variation of lung and fibrotic tissue volumes over the follow-up period. MC and conventional dose- and normalized total dose-response curves were generated for the RT-induced fibrosis. Fibrosis probability was shown to increase with increasing conventional and MC dose as well as with increasing conventional and MC normalized total dose. Moreover, fibrosis probability was also correlated with MC predicted hot spots in high dose regions.

Conclusion: The presented tool allows a systematic numerical study of the relations between RT-induced fibrosis and dose, normalized total dose and MC predicted hot-spots in high dose regions.