AbstractID: 9018 Title: Motion characterization for early stage non-small cell lung cancer

Purpose: With the increasing use of conformal radiation therapy methods for lung cancer, it is a necessity to accurately determine respiratory induced tumor motion. The purpose of this study is to analyze the motion characteristics of early stage lung tumors in a large population, and correlate tumor motion with position and other clinical factors.

Method and Materials: 113 patients with 119 early stage non-small cell lung tumors were analyzed. Each patient received a 4DCT scan. To determine tumor motion, a soft-tissue based rigid registration algorithm was used to track the tumor position in ten respiratory phases. Tumor positions were standardized to correlate with their motion characteristics and other clinical factors, which included the lobe location, TMN staging information and etc. Diaphragm motion was calculated by subtracting the diaphragm position between the expiration and the inspiration phase. Tumor volumes were determined based on the GTV drawn by physicians on the expiration phase.

Results: Average tumor motion in the AP, SI, and RL directions were 3.1±2.2mm, 6.3±6mm, and 1.5±1.4mm respectively. Lower lobe tumors showed an average vector motion (±1SD) of 11.6±7mm while upper/mid lobe tumors only averaged 5.3±4mm. To fully cover 95% of the tumors, a margin of 6.8mm, 18.3mm, and 3.9mm was needed in the AP, SI, and RL directions. From two-tailed Spearman's rho correlations, tumor SI motion was strongly correlated with AP and SI positions of the tumor in the thorax, with correlation coefficients of -0.418 and 0.584 respectively. Diaphragm motion and tumor volume were not correlated with tumor motion.

Conclusion: Respiratory induced lung tumor motion is primarily in the SI direction. Tumors in the lower lobe on average double the motion range of upper/mid tumors. Because the magnitude of tumor motion is different in each direction, it is beneficial to use an asymmetrical CTV margin for radiotherapy planning.