AbstractID: 1639 Title: Tumor Motion Mapping Using Four Dimensional Computed Tomography

Our previously described technique for incorporating spirometry-gated, 4D-computed-tomography (4DCT) into conformal treatment planning has been performed on 19 patients. Breathing characteristics were evaluated as a function of percentile volume, defined as the tidal volume at which the selected percent time was spent at or below the corresponding volume. Analysis of spirometry records showed substantial variability in breathing, with tidal volumes differing by a factor of 3. For most patients, the 90^{th} percentile represented the largest volume that could be reconstructed without introducing inaccuracies due to sampling error. To evaluate whether the 90^{th} percentile adequately represented the extent of breathing, the 98^{th} percentile was used as a baseline for maximum inhalation. The ratio of the 98^{th} to 90^{th} percentile demonstrated remarkable consistency (1.30±0.10), independent of tidal volume, suggesting that a 30% extrapolation beyond the 90^{th} percentile motion is appropriate. Center-of-volume coordinates on inspiratory and expiratory reconstructions were compared to determine the tumor motion trajectory for ten lung-cancer patients. The average motion was 0.17±0.12cm, 0.31±0.26cm and 0.59±0.54cm in the mediolateral, anteroposterior and craniocaudal directions. The average total motion for all tumors was 0.75±0.48cm, with a maximum displacement of 1.8cm. Preliminary clinical data suggest that tumor motion for most patients may be small enough that standard or reduced planning target margins are sufficient; however clinicians cannot know a priori into which category a patient will fit. 4DCT may therefore be a useful tool in treatment planning for lung-cancer patients to accurately determine their specific organ motion characteristics and customize treatment accordingly.