

## AbstractID: 7175 Title: New tools and methodology for Stereotactic Body Radiotherapy (SBRT) simulation using 4DCT

**Purpose:** To describe a new 4DCT SBRT simulation protocol and implement new virtual simulation tools to assess the impact of 4DCT simulation in the presence of abdominal compression

**Methods and Materials:** Under a pre-4DCT SBRT simulation protocol, targets were derived from 2 separate helical CT acquisitions interspaced by patient repositioning to capture snapshots of the respiratory cycle and setup errors. 4DCT SBRT simulations are performed under forced shallow breathing with patients immobilized within a commercially available bodyframe with abdominal compression. Cine CT images were retrospectively gated to produce 4DCT datasets. The datasets were subsequently transferred to a virtual simulation workstation. The software allows for the manipulation of 3-D datasets of the individual phases of the breathing cycle, mean intensity projections and PET scans all within one interface.

Image data from 4 patients was acquired and analyzed to quantify the residual internal tumor motion in the presence of the compression device. For 2 of the 4 patients, new multimodality virtual simulation tools were used to draw planning target volumes utilizing 4D and multimodality data.

**Results:** Mean residual internal tumor motion was measured to be  $1.4\text{mm}\pm 0.3\text{mm}$ ,  $0.85\text{mm}\pm 0.51\text{mm}$  and  $2.83\text{mm}\pm 2.12\text{mm}$  in the lateral, anterior-posterior and cranial-caudal directions. A plot of GTV center-of-mass trajectories suggests a phase shift. A volume comparison of the pre- and post-4DCT methods of determining planning target volumes demonstrated that for 2 patients, the pre-4DCT derived target volumes were larger but generally agreed with the 4DCT phase data spatially.

**Conclusions:** Combining abdominal compression with 4DCT is feasible as a means of explicitly accounting for temporal variations in target position with patient-specific respiratory motion margins. Based on this initial data, explicit inclusion of 4DCT measured target motion in the SBRT treatment planning process was chosen as the preferred method of motion-management in our clinic over gated delivery approaches for most patients.