

AbstractID: 10433 Title: Functional planning for Tomotherapy-based stereotactic body radiotherapy (SBRT) for peripheral lung tumors

**Purpose:** To investigate the impact of incorporating hyperpolarized helium-3 (HP He-3) MRI ventilation images to Tomotherapy-based stereotactic body radiation therapy (SBRT) planning for peripheral lung tumors.

**Method and Materials:** CT and HP He-3 MRI ventilation images of 6 subjects were co-registered for segmentation. Highly functional lungs (HFL) were defined as the 70-percentile hyperventilation lungs and less functional lungs (LFL) were subsequently calculated. A cylinder-shaped artificial object was created in peripheral lungs to mimic planning-target-volume (PTV). Two Tomotherapy-based IMRT plans, an anatomical plan (Plan 1) and a functional plan (Plan 2), were designed with SBRT-type prescription (60Gy in 5 fractions) and normal tissue constraints. The following dosimetric parameters were compared between two plans: total lung  $V_{20}$  ( $TLV_{20}$ ), highly functional lungs  $V_{20}$  ( $HFLV_{20}$ ), less functional lungs  $V_{20}$  ( $LFLV_{20}$ ), mean total lung dose (MTLD), mean highly functional lung dose (MHFLD), mean less functional lung dose (MLFLD), max dose to organs at risk (OARs) and conformity index (CI).

**Results:** Compared to Plan 1, Plan 2 significantly reduced  $HFLV_{20}$  (median reduction 2.1%, range 0.7-2.9%,  $p$ -value=0.031),  $TLV_{20}$  (median reduction 1.6%, range 0.5-2.1%,  $p$ -value=0.031), MHFLD (median reduction 0.8Gy, range 0.4-1.0Gy,  $p$ -value=0.031), and MTLD (median reduction 0.7Gy, range 0.1-1.0Gy,  $p$ -value=0.031). There was no significant difference in  $LFLV_{20}$  and MLFLD ( $p$ -value is 0.438 and 0.156 respectively). Dose constraints for OARs were satisfied in all plans and max doses to OARs were not significantly changed in Plan 2 ( $p$ -values range: 0.063-0.563). CI was generally reduced in Plan 2 (median reduction 0.02) but the difference is insignificant ( $p$ -value=0.125).

**Conclusions:** The incorporation of HP He-3 MRI ventilation information to the Tomotherapy-based SBRT planning for peripheral lung cancer improved the sparing of radiation dose to highly functional lungs and can potentially preserve more highly functional lungs.

**Conflict of Interest:** Dr. Paul W. Read serves as a consultant for Tomotherapy Inc.