AbstractID: 13846 Title: Dose to proximal bronchial tree in lung SBRT treatments: Comparison of Pencil beam and Monte Carlo dose distributions

**Purpose:** Increased dose to proximal bronchial tree (PBT) has been associated with higher incidence of toxicities in prior lung SBRT trials. In this study, the effect of pencil beam (PB) dose calculations on the PBT dose for targets within the PBT zone was evaluated using Monte Carlo (MC).

**Methods:** Lung SBRT plans with PTVs within the PBT zone were generated for 10 patients using a commercial treatment planning software equipped with PB and MC algorithms. PBT within 2 cm of the PTV region was contoured on CT datasets for all patients. Treatment plans were generated using two different dose calculation methods: i) Pencil beam algorithm without inhomogeneity correction (PB-IHC), and ii) PB with inhomogeneity correction (PB+IHC). Both plans for each patient had identical beam geometry, but different MLC shapes were used to achieve similar conformal dose coverage of PTV. All plans were normalized to have 98% of PTV receive 60Gy in 3 fx. Dose distribution for each plan was recalculated with MC by keeping the monitor units the same in respective plans. Dosimetric comparisons were performed between PB-IHC, PB+IHC, and MC based dose distributions, where MC dose distributions were assumed to be the gold standard.

**Results:** The MC mean values for PTVD95, PTVDmax, PBTDmean, and PBTDmax outside the PTV region were 67.7Gy, 83.1Gy, 38.5Gy, and 64.5Gy respectively. These values were higher than PB-IHC by 9%±4.5%, 17%±9%, 19%±6%, and 16%±5.8%, and were lower than PB+IHC by 13%±4.7%, 9%±1.5%, 5%±1.8%, and 8%±2.4%, respectively.

**Conclusion:** Compared to MC, PB+IHC overestimates the dose to both PTV and PBT, and PB-IHC underestimates the dose to both PTV and PBT. Unrecognized dose hotspots in this region might influence the risk of toxicity to proximal airways. This issue should be considered when analyzing clinical toxicity data calculated using PB-based algorithms without heterogeneity corrections.