AbstractID: 6622 Title: Use of kilovoltage cone beam CT (kV-CBCT) for hypofractionated image-guided radiation therapy (HF-IGRT) of lung tumors

Purpose: We retrospectively studied geometric and dosimetric differences between bony (vertebral body-based) and soft tissue (GTV-based) registrations of kilovoltage cone-beam CT (CBCT) scans for setup and intra-fraction motion assessment of lung tumor patients receiving hypofractionated image-guided radiation therapy (HF-IGRT).

Method and Materials: kV-CBCT scans were acquired before and after HF-IGRT treatment for ten patients with lung tumors. Pre-treatment CBCT was registered with planning CT using GTV-based and bony registrations to determine the treatment isocenter. Isocenter positions and tumor and normal tissue DVHs were compared for the two registration types. Intra-fraction motion of vertebral bodies and GTV during the approximately half-hour treatment was determined from pre- and post-treatment CBCTs acquired at the same isocenter. Normal tissue doses were evaluated.

Results: The average ±1 SD differences (mm) between isocenter position determined by bony and GTV registrations of planning CT with pre-treatment CBCT are 1.8±4.2 (left-right), 0.5±5.7 (ant-post), 0.6±3.6 (sup-inf), and 6.4±4.5 (3-D magnitude). For 6 patients, the distance between the GTV and bony registration isocenters exceeded 5 mm. For the clinical margins used (1 cm GTV-PTV), coverage and most normal tissue DVHs were minimally affected by registration type except for maximum bronchus dose in one patient that increased by 15 Gy. For 7 patients, GTV and vertebral intra-fraction motion determined from the pre- and post-treatment CBCTs, was similar. The average difference was 2.3±1.6 mm with a maximum in one patient of 5 mm. Except for one maximum bronchus dose increase of 18 Gy, normal tissue dose changes were small.

Conclusion: Isocenter positions determined by bony and GTV registration can differ by more than 5 mm. This can affect normal tissue doses and, for reduced margins, target coverage. For target dose delivery, GTV-based registrations are more accurate. Difference in intra-fraction GTV and vertebral motion is often, but not always, within 3 mm.