AbstractID: 6815 Title: Dosimetric impact of cone beam image guided setup for paraspinal patients

Purpose: To quantify the impact of kV cone beam CT (CBCT)-guided setup on delivered dose to target and critical organs in patients receiving paraspinal irradiation and to compare the relative benefits of CBCT versus orthogonal kV radiograph (2D)-guided setup.
Method and Materials: Initial, pre- and post-treatment CBCTs from ten patients receiving single-fraction radiotherapy were evaluated. Delivered dose based on CBCT-guided treatment was calculated after transferring target and critical organ contours from pre-treatment CBCT to planning CT. Similarly, delivered dose from a simulated 2D setup was calculated by registering orthogonal DRRs created from the initial CBCT with planning DRRs using bony anatomy, and then applying the resulting shifts to the initial CBCT contours before transfer to the planning CT. The magnitude of residual setup errors and intra-fractional motion were evaluated by registering pre-treatment CBCT to planning CT and post- to pre-treatment CBCT, respectively.
Results: Dosimetric impact was evaluated using PTV $D_{95\%}$ and maximum dose to critical structures. Even with CBCT-guided setup, small residual setup errors combined with steep dose gradients led to increases up to 27% in maximum cord dose. Likewise, increases in esophagus maximum dose up to 34% (CBCT) and 20% (2D) were observed. PTV $D_{95\%}$ decreased to 85% (CBCT) and 87% (2D) of planned dose for one patient with a low planned PTV $D_{95\%}$ (73%) and a steep dose gradient. Magnitudes of the 3D vector of residual setup errors following 2D and CBCT setup were 2.3±0.5 mm and 1.5±0.4 mm, respectively. The intra-fractional error was 1.6±0.3 mm.
Conclusion: Since paraspinal lesions occur near stable bony anatomy with no significant anatomical deformation, CBCT provides no additional benefit over 2D techniques for accurate positioning. CBCT does provide easier visualization of the anatomy to facilitate setup and CBCT requires about the same effort as 2D setup based on orthogonal kV-images.