AbstractID: 13768 Title: Comparison of respiration-correlated and uncorrelated cone-beam CT for correcting target-positioning errors in radiotherapy of thoracic and abdominal cancer

Purpose: This study compares respiration-correlated kV cone beam CT (RC-kVCBCT) image guidance to standard (uncorrelated) kVCBCT for target localization in radiation treatment of thoracic and abdominal tumors. **Method and Materials:** In an IRB-approved study, 9 stage II-IV non-small cell lung cancer (NSCLC) patients and 1 stage III stomach tumor patient with fiducials received a respiration-correlated planning CT (RCCT) at simulation and five RC-CBCTs during the first week of treatment. The GTV volumes ranged from 2.8 cm^3 – 286 cm^3. Kilovoltage RC-CBCT scans are acquired (Varian Trilogy) while recording respiration and with reduced gantry speed (0.2 rpm), yielding 3D images at six respiratory phases. The tumor in each phase of the RC-CBCT is registered to the end-expiration (EE) phase image to obtain the respiration-averaged tumor displacement relative to its EE position. This process is repeated in the RCCT image set. The RCCT and RC-CBCT images at EE are registered to obtain the tumor displacement at the EE position. A vector sum of the three displacements yields the correction to the respiration-averaged tumor position. For comparison, the correction is also computed by matching an uncorrelated CBCT reconstructed with all projections and representing a respiration-averaged image, to the average intensity projection image computed from the RCCT. **Results:** The mean difference between the two correction methods in 10 patients was 1.4mm left-right (L/R), 1.6mm anterior-posterior (A/P), and 1.7mm superior-inferior (S/I). The maximum difference was 5.0mm (L/R), 6.0mm (A/P), 7.0mm (S/I). The GTV range-of-motion at simulation ranged from 2-14mm. **Conclusion:** Our preliminary results suggest that for many thoracic and abdominal tumors, position corrections using uncorrelated, respiration-averaged 3D imaging are consistent with those from respiration-correlated imaging; however, respiration-correlated imaging may be indicated for cases of large tumor motion. Research supported by Varian and by NIH grant T32 CA61801.