Intrafraction Cone Beam Computed Tomography Imaging Evaluation During Stereotactic Body Radiation Therapy For Lung Tumors and Metastatic Tumors to the Spine

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Purpose: This study aims to assess the displacement and the time relation from pre-treatment to mid-treatment CBCT acquisition during SBRT for lung tumors and metastatic tumors to the spine.

Materials and Methods: 258 SABR fractions were analyzed in total, including 774 translational vectors to evaluate intra-fraction displacement: 193 fractions from 50 patients with early stage non-small cell lung tumors and 65 fractions from 15 patients with vertebral metastatic tumors included in this retrospective study. All patients underwent SBRT at our center; treatment was delivered with RapidArc with a flattened 6-MV photon beam between April 2012 and June 2013. Precise reproducible patient positioning was routinely obtained with the stereotactic double-vacuum whole body immobilization system (BodyFIX, Medical Intelligence). The vertical, longitudinal and lateral vectors were obtained by using local rigid registration of the vertebra located at the level of the region of interest on pre/mid-treatment CBCT scans. Clinical data was obtained to assess the presence of a correlation with the displacement: age, gender, Karnofsky performance status, and pulmonary function test.

Results: For lung tumors, 579 translational vectors were obtained from the 193 fractions: mean vertical, longitudinal and lateral motions were -0.2 mm (SD=0.9 mm), -0.5 mm (SD=1.0 mm) and -0.1 mm (SD=0.9 mm). Maximum absolute vertical, longitudinal and lateral motions were 3.0 mm, 4.0 mm and 4.0 mm. The mean translational motion vector was 1.4 mm (SD=0.9 mm). For spine tumors, 195 translational vectors were obtained from the 65 fractions: mean vertical, longitudinal and lateral motions were 0.0 mm (SD=0.8 mm), -0.1 mm (SD=0.6 mm) and 0.1 mm (SD=0.7 mm). Maximum absolute vertical, longitudinal and lateral motions were 2.0 mm, 2.0 mm and 2.0 mm. The mean translational motion vector was 0.9 mm (SD=0.7 mm). Mean time from pre-treatment to mid-treatment CBCT acquisition (Δ CBCT) for the 258 SABR fractions was 23 min (SD=6 min). The translational motion vector did not correlate with the time from pre-treatment to mid-treatment CBCT acquisition in lung and spine tumors, and any of the clinical patient characteristics analyzed.
**Conclusions:** The displacement from pre-treatment to mid-treatment CBCT during SBRT for lung and spine tumors is minimal, and does not correlate with the imaging time acquisition.