

Purpose: This study investigated the patterns of intra-fractional motion and accuracy of treatment setup strategies in 3D-CRT APBI for right- and left-sided breast cancer.

Methods: 16 right and 17 left breast cancer patients were enrolled in an institutional APBI trial in which gold fiducial markers were strategically sutured to the surgical cavity walls. Daily pre- and post-RT kV imaging were performed and were matched to DRRs based on bony anatomy and fiducial markers, respectively, to determine the intra-fractional motion. The positioning differences of the laser-tattoo and the bony anatomy based setups with respect to the marker based setup (benchmark) were determined to evaluate their accuracy. Student t test was employed to evaluate the differences between the right- and left-sided breast treatments.

Results: Statistical differences were found between the right- and left-sided APBI treatments in vector directions of intra-fractional motion and treatment setup reference systems, but not in their magnitudes. The directional difference was more pronounced in the lateral. It was found that the intra-fractional motion and setup reference systems tended to deviate in the left direction for the right-sided breast treatments and in the right direction for the left-sided breast treatments. Average intra-fractional motion magnitude was 4.3 vs 4.8 mm and was 2.7 vs 3.0 mm based on the marker and bony anatomy matching, respectively, for right and left breast treatments. The bony anatomy and laser-tattoo based inter-fractional setup errors were 6.4 vs 7.5 mm, and 9.5 vs 9.2 mm, respectively.

Conclusions: It appears that the fiducial markers placed in the seroma cavity exhibits side dependent directional intra-fractional motion. Although bony anatomy based treatment setup improves the accuracy over laser-tattoo, it is inadequate to rely on bony anatomy to assess intra-fractional target motion in both magnitude and direction. These data further support that a seroma specific approach is the key to improve treatment accuracy.