

AbstractID: 13520 Title: Evaluation of Residual Errors in Online Guidance of Primary and Nodal Targets in Lung Cancer

Purpose:

To evaluate the accuracy of online guidance for primary and nodal lung cancer targets

Method and Materials:

Weekly CT scans under active breathing control were acquired during treatment for 18 patients enrolled as research subjects. Separate primary gross tumor volume (GTV_P) and involved lymph node $GTVs$ (GTV_{LN}) were delineated by a physician on all images. Each weekly online image was aligned to the reference (planning) image automatically using a rigid image-based registration. Four rectangular regions of interest were evaluated for the ability to match the target structures: the whole image; the $GTV_P + 1$ cm; the $GTV_{LN} + 1$ cm; and both the GTV_P and $GTV_{LN} + 1$ cm. The $GTVs$ on the online images were translated according to this new registration, and the centroid displacements of the delineated $GTVs$ were calculated to measure the residual error after image-based alignment.

Results:

The mean absolute error was 5.1 ± 4.7 mm for the GTV_P and 6.4 ± 6.9 mm for the GTV_{LN} . The combined mean absolute error was 5.7 ± 5.9 mm for both structures. Rigid registration of $GTV_P + 1$ cm yielded the smallest residual error (RE) for the primary tumor of 3.3 ± 3.9 mm, with a RE of 4.8 ± 4.8 mm for the lymph nodes. Registration of $GTV_{LN} + 1$ cm provided the smallest RE for the lymph nodes of 4.1 ± 5.8 mm, though the primary tumor RE was 5.0 ± 4.9 . The smallest combined RE for both structures was 4.0 ± 4.5 , which was obtained using rigid registration of the $GTV_P + 1$ cm.

Conclusion:

Shape, volume, and relative position change of multiple targets introduces error into soft-tissue localization in locally-advanced lung cancer, although tumor regression was the dominant source of error. Deformable registration methods may be required to improve localization accuracy.