AbstractID: 9404 Title: 4D Treatment Planning and Dosimetric Validation of Helical Tomotherapy Treatments of Moving Tumors

Purpose:

The objectives of this study are to describe the 4D treatment planning process for moving targets and to evaluate the dosimetric consequences caused by target motion during tomotherapy delivery.

Methods:

A lung cancer patient was CT scanned using our standard 4D-CT protocols on Phillips brilliance 64 slice CT scanner. A maximum intensity projection CT dataset was used for treatment planning. Tumor motion trajectory and amplitude was determined from the inhale and exhale phases of the 4DCT. A three-dimensional motion pattern was created by scaling the breathing form to an average magnitude of the target motion. The three-dimensional trajectory was programmed into the Washington University 4D Phantom to simulate target motion.

Eight EDR2 films were loaded into a phantom for dosimetric verification. Measurements were performed on a static phantom and then repeated on the oscillating phantom. Experiments were repeated for their reproducibility. Films were analyzed using Hi-Art TPS.

Results:

To quantify the dose errors, gamma analysis was performed. In static phantom study, >97% of the points passed with a gamma criteria of 3% and 3mm. When the same criterion was applied for the oscillating phantom, 15-25% of the points failed. When the gamma threshold was increased to 8% and the gamma analysis window was tailored to be within the CTV, >98% of the points passed indicating that the dose errors are of the order of 5% for majority of the points. In order to find the maximum dose errors, the tolerance was increased until 100% of points passing the criteria.

Conclusions:

4D treatment planning process for helical tomotherapy is discussed. Gamma analysis revealed that, the dose errors are of the order of 5% for majority of the points and the maximum dose error within the CTV was 11%.

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