

AbstractID: 8907 Title: Planning Margin Determination of Concomitant Boost Treatment Planning for 3D-Conformal, IMRT, and Stereotactic Lung Cancer Radiotherapy

Purpose:

To determine appropriate planning margins around the GTV for concomitant boost image-guided lung cancer treatments where the GTV is prescribed a higher dose than the CTV.

Method and Materials:

The dosimetric impact of the GTV planning margin (pGTV) margin was investigated with 3D isotropic expansions to the GTV, and simulations of interfractional target displacements relative to bone. Seven patients (IMRT and 3D-conformal stereotactic) were included. GTVs and their respiratory motion envelopes were contoured from 4DCT images.

All patients were aligned with daily projection imaging (IMRT) or CT (SBRT); perfect bony anatomy alignment was assumed. Average residual uncertainties (tumor versus bone) were previously determined from analysis of CBCT images. A 3D displacement probability map was calculated (0.0 ± 3.4 mmAP, 0.8 ± 3.4 mmSI, and 0.5 ± 2.7 mmRL), assuming setup errors were normally distributed. To determine the worst-case dose-coverage, pGTVs were created by expanding the GTV by 6mm (95.5% probability). Cumulative dose distributions were calculated based on the 3D displacement probability map. The assumption of normally distributed displacements was not appropriate for hypo-fractionated patients; therefore a worst-case systematic displacement scenario was evaluated for one patient.

Results:

The 4mm pGTV demonstrated good dose coverage ($> 90\%$). With the current planning techniques, the worst-case analysis of GTV coverage showed that usually $\leq 5\%$ GTV would receive $< 95\%$ Rx dose. Differences between the planned and cumulative dose distributions were minimal. For the hypofractionated Patient, the probabilities that the GTV will receive at least 98%, 96%, 94%, and 92% of the prescribed dose are 42%, 78%, 93%, and 95% respectively.

Conclusion:

Prescribing 90%-100% of the prescription dose to the GTV + 4mm planning margin should result in sufficient dosimetric coverage of the GTV for both IMRT and hypo-fractionated stereotactic patients. When prescribing concomitant boosts a pGTV margin is required, but this need not be as great as the PTV margin around the CTV.