

AbstractID: 2620 Title: Residual tumor motion in external respiratory gated lung cancer treatment

Purpose: To mitigate the motion-induced irradiation of healthy lung tissue, clinics have begun using external markers to gate the therapy beam. This technique assumes that the correlation between the external signal and the internal tumor position remains constant inter-fractionally and intra-fractionally. A study has been performed to assess the validity of this correlation assumption within a gating window.

Method and Materials: Eight lung patients with implanted fiducials were studied. Synchronized internal and external data was taken during the entire course of treatment. Stereoscopic imaging was used to find the internal markers in four dimensions. The data was used retrospectively to assess conventional external surrogate respiratory-gated treatment. Both amplitude and phase-based gating methods were investigated. For each method, three gating windows were investigated, each giving 40%, 30% and 20% duty cycle, respectively. The residual motion of the internal marker within these six gating windows was calculated. The beam-to-beam variation and day-to-day variation in the residual motion were calculated for both gating modalities.

Results: We found that the residual motion (95th percentile) was between 0.9-6.2 mm for a 40% duty cycle window. There is no clear preference for either gating modality. Large fluctuations (>300%) were seen in the residual motion between some beams. Overall, the mean beam-to-beam variation was 37% and 42% for amplitude and phase-based gating, respectively, compared to the previous beam. The day-to-day variation was 29% and 34% for amplitude and phase-based gating, respectively, compared to the previous day.

Conclusion: Although gating significantly reduced tumor motion, the residual motion behaved unpredictably. Treatment margins that account for motion should be individualized and daily imaging should be performed to ensure that the residual motion is not exceeding the planned motion on a given day.

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