

AbstractID: 6825 Title: The Reliability of Surrogates in Predicting Tumour Motion: A comparison of surrogate based and non-surrogate based approach

Purpose: To assess the interfraction reproducibility of external surrogates in predicting lung tumor motion and to compare that with the reliability of the non-surrogate approach

Methods: 10 patients with fluoroscopically visible non-operable lung tumors were studied. Data were acquired twice for each patient, pretreatment and post 20 fractions. Chest and abdominal wall surface motion was measured with 3D photogrammetry of retro-reflective skin markers. Simultaneous time-stamped A/P fluoroscopic images were used to determine tumor motion in two dimensions. A linear model was formulated to describe the relationship between the surface markers and tumor motion and then applied to predict tumor motion during both the first and second visit. Quantification of the difference between the predicted and actual tumor position demonstrated the surrogate's ability to predict tumor motion. This difference defines the Internal Margins (IM) that must be applied when the surrogate is employed for tracking or gating. Comparison of IM's thus obtained over a four week course of radiotherapy would give a measure of the reliability of the surrogate.

Results: Comparison of surrogate based margins on day1 and day20 indicated that prediction ability of the surrogate deteriorated during this time and the required IM' increased by an average of 1.27mm. Furthermore, analysis of non-surrogate-based case showed that tumor motion amplitude had increased significantly from day1 to day20 requiring an average increase of 1.16 mm in the IM's. Statistical analysis showed that for both cases assuming a 6mm additional margin would provide the desired tumor coverage with a 99% C.L.

Conclusions: Predictive models of motion can reduce the IM component of the PTV by a significant volume, however interfraction reproducibility is poor and the chance of geometric miss is high. Our observations of tumor motion variability suggest that static field margins should also be reassessed over a standard treatment course.