AbstractID: 10486 Title: Evaluation of tracking versus conventional delivery for lung cancer radiotherapy via 4D treatment planning

Purpose: Apply 4D treatment planning techniques to evaluate tracking versus conventional delivery for lung radiotherapy

Method and Materials: This was a retrospective study involving 4DCT data from 6 patients previously treated for lung cancer with tumor extent of motion within the range [2mm, 10mm]. Ten image sets corresponding to various phases of the respiratory cycle were derived from each 4DCT data set and a single clinician contoured the target and organs at risk on all image sets. Two treatment plans were developed per patient based on tracking and conventional radiotherapy. In the conventional plan, bigger margins were used to account for organ motion. First, a composite target was derived based on the delineated targets across all image sets then a treatment plan was developed per image set based on the composite target. Tracking was characterized by reduced margins as the treatment plan consisted of ten independent plans developed per image set. The 4D dose was derived by deforming each of the dose distribution computed per image set to a chosen reference image set and summed. We then evaluated the two techniques for biological tumor coverage adequacy and normal tissue sparing by quantifying the target generalized equivalent uniform dose (gEUD), lung V_{20}, mean lung dose (MLD) and a relative conformity gradient index (CGI).

Results: On average, the gEUD discrepancy was within 5%, the lung V_{20} and MLD decreased by (17+/-4) % and (15+/-3) % respectively and the relative CGI increased by (22+/-12) points from conventional to tracking radiotherapy plan. This result excludes two patients with tumor motion less than 5mm as there was insignificant variation between the two techniques.

Conclusion: Conventional and tracking techniques are comparable in terms of target coverage but tracking results in far more normal tissue sparing making it a more attractive delivery type for lung cancer radiotherapy.