

AbstractID: 10481 Title: Tracking versus gating for lung cancer radiotherapy. A retrospective study involving 5 patient 4DCT data sets.

Purpose: To compare tracking versus gating for lung cancer radiotherapy using actual patient 4DCT data.

Method and Materials: This study involved 4DCT data from 5 patients treated for lung cancer with tumor extent of motion within the range [4mm, 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 each image set. Two treatment plans were developed per patient based on tracking and gated radiotherapy. The gating plan assumed a 30% duty cycle meaning that three out of the ten contiguous image sets were incorporated into the treatment plan. For these image sets, a composite target was derived which was the union of the delineated targets and a treatment plan was developed per image set based on the composite target. The tracking plan consisted of ten independent plans developed per image set. The 4D dose was derived by deforming each of the weighted dose distributions computed per image set to a chosen reference image set and summed. The two techniques were then evaluated for biological tumor coverage adequacy and normal tissue sparing by using the target generalized equivalent uniform dose (gEUD), lung V_{20} , mean lung dose (MLD) and a relative conformity gradient index (CGI). The CGI ranks two plans in terms of quality and desirability.

Results: On average, the gEUD discrepancy was within 4% among the plans. However, the lung V_{20} and MLD decreased by (12+/-6) % and (7+/-2) % respectively and the relative CGI increased by (12+/-8) points from gating to tracking radiotherapy plan.

Conclusion: Adequate tumor coverage can be achieved using either of the delivery techniques. Tracking results in significantly improved normal tissue sparing, making it a more attractive delivery technique for lung cancer radiotherapy.