AbstractID: 3578 Title: Forward planning to account for motion of intrathoracic targets compared to the standard pre-treatment target expansion method based on internal target volume (ITV)

Purpose: To compare geometric methods currently recommended by the ICRU versus forward dose calculation inclusive of motion for treatment planning of intrathoracic targets.

Method and Materials: A deformable alignment tool (based on thin plate splines) is used to find the transformation from the exhale to the inhale CT volumes of the patient. Using this transformation and the exhale-defined gross target volume (GTV), inhale and mid-ventilation GTV volumes are constructed. These GTV volumes are then summed to make the internal target volume (ITV). A conformal plan is created to cover the ITV volume with 95% dose. To subsequently account for motion for this plan, dose is averaged over inhale, exhale and mid-ventilation phases by mapping the density grid of the treatment planning CT scan to these breathing phases, calculating the dose at each phase, and mapping the dose grid back to the reference CT.
In the forward planning method the plan is first conformed to the exhale GTV and then modified after each dose calculation (using the same method as above to account for motion) by adjusting the MLC leaves until the moving GTV is covered with 95% dose.

Results: The impact of breathing motion on total dose to GTV and lungs was accounted for in both planning methods. The dose volume histograms (DVH) of the lungs showed a decrease of about 3% in the lung volume irradiated to higher doses for the forward planning infrastructure compared to the standard ITV planning. The forward planning reduced the total volume within the 95% isodose surface compared to the ITV plan.

Conclusions: Forward planning that is robust to breathing movement is feasible. Minor decreases in lung dose compared to geometric methods warrant further investigation.

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