AbstractID: 11304 Title: Complementing targeted radionuclide therapy with external beam radiotherapy: planning study

Purpose: Combining intensity modulated radiotherapy (IMRT) with targeted radionuclide therapy (TRT) can reduce local radiation toxicity. TRT systemically distributes the toxicity but its non-uniform tumor doses are difficult to complement with conventional IMRT, which warrants more sophisticated voxel-based prescriptions. The purpose of this work was to investigate feasibility of combined TRT/IMRT therapy to achieve uniform tumor coverage.

Methods and Materials: A NSCLC case with highly heterogeneous tumor radionuclide uptake was investigated. The voxel-based TRT dose was estimated using STRATOS (Systemic Targeted Radiotherapy Optimization Solution), a research plug-in within Pinnacle^{TM}. The voxel-based IMRT dose distributions were obtained via the in-house treatment planning software simulating helical tomotherapy delivery. The total tumor dose was kept at 70 Gy in the study. A parametric experiment with varying maximum TRT doses was performed. A supplementing IMRT prescription was defined as the difference between the total tumor dose and the TRT dose. The PTV uniformity of the combined therapy was measured using DVHs as well as evaluating tumor dose profiles.

Results: In this particular case, the TRT doses were highly non-uniform, also requiring highly non-uniform IMRT dose distributions. Regardless, the resulting combined TRT/IMRT plans were highly uniform. DVH analysis demonstrated that a lower TRT dose provides a more uniform tumor dose which can be attributed to a higher fraction of IMRT. The volume percentage within 5% of the prescription was 67, 61, and 55% for the maximum TRT dose of 50, 60, and 70 Gy, respectively. The DVHs also show the difficulty in conforming to the prescription in low density regions which is due to lack of dose build-up that inhibits modulation of steep dose gradients.

Conclusions: Preliminary results suggest that it is feasible for helical tomotherapy to complement TRT in providing uniform tumor dose coverage.