

AbstractID: 13235 Title: Deformable Model Based Dose Reconstruction for Total Body Irradiation with Helical TomoTherapy

Purpose: We have developed a megavoltage CT (MVCT) based dose reconstruction strategy for total body irradiation (TBI) with Helical TomoTherapy (HT, TomoTherapy, Inc, Madison, WI) using a deformable registration model to retrospectively account for interfraction changes in the region of interest (ROI).

Methods and Materials: Two patients with acute myelogenous leukemia treated with TBI using HT were selected for this study. The prescription was 12 Gy, 2 Gy/fraction, twice a day given 6 hours apart. The original plan achieved coverage of 80% of the CTV by the 12 Gy isodose cloud. MVCTs were acquired prior to each treatment. ROIs were contoured on each MVCT. The dose for each fraction was calculated based on the MVCT on the HT Planning Adaptive Station (TomoTherapy, Inc, Madison, WI). B-Spline deformable registration was conducted to establish voxel-to-voxel correspondence between the MVCT and the planning CT. The resultant deformation vector was employed to map the reconstructed dose from each fraction to the same point as the plan dose and then obtain a voxel-to-voxel summed dose from all six fractions. The reconstructed dose distribution and its dosimetric parameters are compared with those of the original treatment plan.

Results: Significant changes in CTV contours occurred in both patients. The reconstruction showed that the DVH for CTV coverage is close ($< 1.5\%$) to that of the original plan. For sensitive structures the differences between the reconstructed and the planned doses were less than 4.0%.

Conclusion: A voxel based dose reconstruction strategy taking into account interfraction anatomical changes using MVCTs is a powerful tool for treatment verification of the delivered doses. This proposed technique can also be applied towards adaptive TBI therapy using HT.