AbstractID: 6968 Title: MRI-Based Treatment Planning for Glioblastoma (GBM): Dosimetric Validation

Purpose: CT and MR fusion errors can be a few millimeters for brain patients due to the geometric complexity of the bony structures. Treatment planning based on MRI alone can remove this fusion error. The purpose of this study is to investigate the dosimetric accuracy of MR-based treatment planning for Glioblastoma.

Method and Materials: An optimal MR image sequence was developed by increasing the bandwidth readout gradient to >100 Hz/pixel in the frequency direction to eliminate the artifacts caused by chemical and susceptibility. Ten paired 3D conformal plans were generated with a 3D planning system using both MRI and CT data. The same internal contours were used in the dose calculation while the external contours were generated from CT and MRI separately. Homogeneous geometry was used in the dose calculation. The same treatment parameters (i.e., energy, gantry angle, block shape and size, and dose prescription) were used in the paired plans for each patient. The same MUs obtained from the CT-based plans were also directly used in the MRI-based plans. The plans were evaluated based on isodose distributions and dose-volume histograms (DVHs) for the target and critical structures.

Results: No significant image distortions are found due to inhomogeneities in the main magnetic field because of the relatively small image space for the brain (12 cm from the isocenter). The external contours are consistent to within 2 mm between CT and MRI. For the patients investigated in this work, the differences are <1.8% in the maximum dose and <3% in D95 (doses at 95% of the PTV) between CT and MR-based treatment plans. By assigning the skull bone with a density of 2g/cm^3 can further reduce the dose differences.

Conclusions: Our study confirmed that treatment planning dose calculation using MRI-derived homogenous geometry is adequate for Glioblastoma (GBM) treatment.