A Comparison of Intracranial Gross Tumor Volumes Generated on MPRAGE and VIBE MR Protocols

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Abstract

Objectives: To compare the gross tumor volume auto-contoured on Magnetization-Prepared Rapid Acquisition Gradient Echo (MPRAGE) and Volumetric Interpolated Brain Examination (VIBE) MR sequences used for stereotactic radiosurgery treatment planning.

Methods: MR imaging was performed for SRS/SRT protocol patients with two different T1-weighted post contrast isotropic imaging sequences: MPRAGE and VIBE. The order of the sequencing study was alternated to eliminate contrast timing being a confounding variable and to vary intra-study patient movement. The 1mm slice spacing was consistent between sequences. Matlab v2018a was used to auto-contour the areas of enhancement (lesion) on both studies. The localized mean separation method developed by Pang et al. (1) was used for active contouring in this study.

Results: The tumor volumes measured from MPRAGE and VIBE sequences using the non-supervised auto-contouring method were compared with manually performed treatment planning system (TPS) contours. Tumor volume measured from MPRAGE is 4.97±5.85 cm3 vs. 3.76±3.7 cm3 from VIBE. The non-supervised auto-contouring method measured tumor volume is 46%±25% vs. 40%±22% of the TPS tumor contour volume. One-way ANOVA analysis showed the p-value = 0.18, which indicates there is no significant difference between the three tumor volume mean measurements.

Conclusions: There are limited patients in the study and the brain tumors had varying primary cancers. A mix of intact and post-operative resections were analyzed. The conspicuity of the tumor affected the performance of the non-supervised auto-contouring. However, the study demonstrated that MPRAGE is in general better than VIBE in contouring the tumor volume using fully automated software with percent difference compared to the gold standard (TPS): MPRAGE 42% vs. VIBE 57%. The auto-contour method in general underestimates the treatment region compared to TPS. In some cases the MPRAGE scan time is < 2.4x VIBE scan time. This quicker scan time can contribute to the reduction in noise in the acquisitions and ultimately the interpretation and contouring.