AbstractID: 4616 Title: Blood-Tumor-Barrier Permeability Changes in High-Grade Gliomas During Radiation Therapy Using DCE MRI

Introduction: Radiation could affect vascular permeability in tumor and normal tissue. A previous study using high-resolution MR images and a contrast uptake index demonstrated that an increase in contrast uptake in the tumor occurs after 30 Gy and persists up to one month after radiation therapy (RT). This finding suggested that an optimal time window exists to increase the efficiency of drug delivery to tumors. In this study, a **quantitative method, *dynamic contrast enhanced (DCE) MR imaging***, was used to assess tumor vascular permeability changes during RT, in order to maximize potential therapeutic benefit.

Methods: Twenty patients with high-grade gliomas who underwent conformal RT participated in a MRI protocol. DCE T2* weighted images were acquired before RT, after ~30 Gy, and one month after the completion of RT. A transfer constant (K) of Gd-DTPA from blood to tissue was estimated voxel-by-voxel and used as a metric for assessment of vascular permeability. In the tumor volume (TV) defined on FLAIR MRI, statistically significant changes in K after ~30 Gy and one month after RT were evaluated, compared to before treatment, using a students' t test.

Results: An average fractional volume of 29.6% in tumor manifested substantial contrast leakage with $K>0.005\ min^{-1}$ pre RT. In the TV where there was no substantial leakage pre RT, the mean K increased significantly from $K=0.0003\ min^{-1}$ to $0.0073\ min^{-1}$ after ~30 Gy ($p<0.0005$) and to $0.0053\ min^{-1}$ one month after RT ($P<0.003$). The fraction of TV that showed substantial contrast leakage significantly increased by 23% after ~30 Gy ($p<0.02$), but not one month after RT ($p>0.5$).

Conclusion: DCE MR imaging reveals vascular permeability increases after ~30Gy in the portion of tumor where leakage is not substantial before RT. This finding suggests that the optimal time to administer chemotherapy is during the course of radiation therapy.