AbstractID: 9096 Title: Clustering Analysis of Dynamic 11C-Methionine PET in GBM for RT Target Definition

Purpose: To assess tumor differentiation in patients with glioblastoma multiforme (GBM) using dynamic 11C-methionin (D-MET) PET and fuzzy c-means (FCM) clustering analysis; and to evaluate the added value of D-MET PET in radiation therapy (RT) target definition.

Materials and Method: D-MET PET images were obtained prior to RT in 25 patients with GBM. Each scan was composed of 15 phases acquired at 0-50 minutes following injection. Conventional MRI was also acquired before RT for target volume definition and after RT for evaluation of treatment outcome. D-MET PET data were normalized to the mean uptake of each individual's cerebellum. Volume of interest (VOI) for the analysis was defined based on pre-RT FLAIR-MRI and extended to incorporate regions of high uptake of MET. Time-activity curves of MET uptake in the VOI were classified using a FCM clustering algorithm with spatial constraints. The optimal number of clusters was determined for each dataset by calculating several clustering validity indices. The results of classification were reviewed by experts; and were also correlated to the patterns of local failure after RT.

Results: Using the FCM clustering algorithm, time-activity curves of MET uptake in the VOI were successfully partitioned into tumor, normal brain tissue, inflammation response, surgical cavity and edema. Heterogeneous MET uptake in the tumor was also differentiated. In 15 of the 25 patients who had tumor progression, the pre-RT PET in the clusters correspondent to the locations of recurrence had a median uptake value of 1.47 (last dynamic phase), which involves clusters beyond the hottest ones.

Conclusion: This study demonstrated that dynamic MET-PET is capable of differentiating active tumors in patients with GBM. It is also promising in providing extra information for RT target definition.

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