AbstractID: 10894 Title: Quantification of Heterogeneous Tumor Blood Volume as Early Predictors for Treatment Outcome in Advanced Head-and-Neck Cancer

Purpose: To evaluate the predicting values of metrics that quantify poorly perfused tumor volumes in patients with advanced head-and-neck cancer (HNC) treated with chemo-radiation therapy (chemo-RT) for outcomes.

Materials and Method: Dynamic contrast-enhanced (DCE) MRI scans were acquired for thirteen patients treated with concomitant chemo-RT for advanced HNC, before therapy and 2 weeks after start of therapy. Blood volume (BV) maps were computed from the DCE MRI. Fuzzy C-means clustering analysis (FCM), a segmentation method for partitioning a dataset into multiple clusters by minimizing the intra-cluster distance among members, was utilized to analyze heterogeneous BV in primary tumor volumes. The pre-treatment tumor BV (TBV) values from all patients were used as training data and partitioned into 2, 3, or 4 clusters using FCM; and the resulting prototype vectors were adopted to partition each individual TBV before and during therapy. The volumes of the clusters with the lowest BV values were tested for their associations with treatment outcome. In addition, the cut-off BV values for the lowest 1 cc, 2 cc, or 5 cc primary tumor sub-volumes were calculated at both time points; and their predicting values for treatment outcome were evaluated.

Results: Four of the 13 patients had local failure. Eight metrics differentiate local failure *vs.* local control significantly: pre-treatment cut-off TBV for the lowest 5 cc ($p=0.03$); average cut-off TBVs of the lowest 2 cc ($p=0.01$) or 5 cc ($p=0.04$) over pre- and during-treatment; the volumes of the lowest TBV cluster at pre-treatment ($p=0.02$), during-treatment ($p\leq0.03$), as well as the average value over pre- and during- treatment ($p\leq0.03$).

Conclusion: Our results suggest that poorly perfused sub-volumes of the tumor before and/or early after start of treatment differentiate local failure *vs.* local control. The metrics discovered here will be candidates for future larger studies.