AbstractID: 13929 Title: Voxel-Based Phenomenological SUV-Dose Response Model for the Human Parotid Glands

Purpose: The goal of this study is to evaluate SUV as an imaging biomarker of parotid function following radiotherapy (RT) and to develop a phenomenological model of SUV-dose response, enabling prediction of the biomarker prior to RT.

Method and Materials: As part of an ongoing study, patients (n = 8) with head and neck cancer (HNC) had ^{18}F-FDG PET/CT studies performed before (within 30 days) and following RT (~50 days). In addition, resting and stimulated whole mouth saliva was collected. Next, a deformable image registration algorithm was utilized to map parotid contours from planning CT (PCT) images to pre- and post-RT PET/CT studies, separately. Mean SUV was then calculated for the parotid glands at both time points and compared to collected saliva. The SUV-dose response relationship was assessed in a separate cohort (n = 60) also treated for HNC. Pre- and post-RT PET/CT images were deformably aligned to PCT images to achieve correspondence between SUV and planned dose. SUV response was then modeled using a single parameter, incorporating planned dose and pre-RT SUV; defined as metabolic dose.

Results: Post-RT stimulated saliva and SUV decreased (59% and 20%, respectively) in seven patients. For one patient, stimulated saliva and SUV increased (14% and 11%, respectively). Fractional SUV correlated significantly with xerostomia grade, $P < 0.01$ and Spearman's $\rho = -0.964$. A second order polynomial provided an adequate fit to the log transformed SUV-dose response curve, adjusted $R^2 = 0.95$. Post-RT SUV was predicted within 3% for an exemplary patient, but overestimated (50%) in the worst case.

Conclusions: Pilot data suggest that SUV is significantly correlated with parotid saliva output. Furthermore, the feasibility of predicting reductions in SUV, prior to treatment delivery, has been demonstrated.

Conflict of Interest: Research partially sponsored by Varian Medical Systems.