AbstractID: 14321 Title: Integrating PET/CT image features for prediction of radiotherapy local failure in lung cancer

Purpose: Radiation therapy (RT) is the main treatment for locally advanced non-small cell lung cancer (NSCLC) patients, but more than half are expected to fail locally. Recent evidence suggests that pre-treatment information from anatomical or molecular imaging may be predictive of local control. Therefore, we are investigating integrating new features derived from PET/CT images into mathematical models to improve the prediction of local response in NSCLC patients. **Method and Materials:** We conducted a retrospective study of 30 NSCLC patients who received RT and underwent pre-treatment FDG-PET/CT scanning. Thirty features were extracted from both PET and CT images. These features included tumor volume; standard-uptake value (SUV) and Hounsfield unit measurements, such as mean, minimum, maximum, and the standard deviation (SD); intensity histogram volume (IVH) metrics such as Ix (minimum intensity to x% highest intensity volume) and Vx (percentage volume having at least x% intensity value); and texture based features such as energy, contrast, local homogeneity, and entropy. In addition, we evaluated correction of motion artifacts using a population-averaged kernel. Logistic regression methods were used for mathematical modeling and Spearman's rank correlation (rs) for evaluating statistical association at 0.05 confidence level. **Results**: Univariate analysis indicated that PET uptake (I40, rs=0.31) and dense/ homogeneous CT (V40, rs=0.4 and SD, rs=-0.31) were correlated with loco-regional failures while highly dense CT volumes (V70, rs=0.39) were more associated with local failure. In loco-regional analysis, a combination of CT-V40 and PET-mean SUV using logistic regression modeling yielded an improved rs of 0.43 while in local failure, a combination of CT-V70 and PET-V80 yielded almost double the association given by any of the two modalities (rs=0.59, $p<0.0001$). **Conclusion:** Our preliminary results indicate a potential complementary relationship between PET and CT derived features that can be used for building improved prediction models of post-RT local failure in NSCLC.