AbstractID: 11167 Title: A Multimodality imaging approach for predicting radiation induced lung injury

Purpose: Radiation pneumonitis (RP), is a major dose limiting toxicity in thoracic irradiation for patients with lung or breast cancer. Multimodality imaging and particularly integrated PET/CT imaging is increasing used in radiotherapy treatment staging, planning, and monitoring. In this work, we are investigating the potential of a new hybrid feature-based approach utilizing post-radiotherapy PET/CT images to predict the risk of later RP.

Method and Materials: As a demonstrative example for analyzing normal tissue toxicities using the proposed multimodality approach, we analyzed post-treatment PET/CT scans (typically, 3 mos. post-RT) of 20 lung cancer radiotherapy patients for the endpoint of pneumonitis. The rate of RP in this group was 20%. The lung region minus the Gross Tumor Volume (GTV) was designated as the region of interest (ROI). We extracted features based on descriptive statistics of intensity (in units of SUV in PET and Hounsfield in CT), image intensity volume histogram (IVH) metrics, and texture-based features. Statistical association was performed using Spearman's rank correlation (Rs).

Results: Thirty candidate features were extracted from each image modality. Preliminary results indicate that texture features in both PET and CT seems to predict RP. For instance, the PET ROI standard deviation had Rs=0.14 in PET and Rs=-0.035 in CT while the texture (related to roughness) local heterogeneity had Rs=0.33 (p=0.08) in PET and Rs=0.63 (p=0.002) in CT.

Conclusion: We have proposed a new approach for predicting RP risk pneumonitis from hybrid PET/CT image features. Texture related features on the post-RT CT scan provide the best prediction. Estimating of these features could provide the physician with an early warning enabling a more proactive management of RP symptoms. Further analysis of these multimodality features, their complementary effect, and the optimal time of imaging, is needed to fully understand this finding.

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