AbstractID: 10997 Title: An evaluation of FDG-PET uptake thresholds for head & neck target definition based on local regions of high inter-observer concordance

Purpose: Thresholding of ^{18}F fluorodeoxyglucose (FDG) uptake imaged with positron emission tomography (PET) has been proposed for radiotherapy target delineation. However, there exists no consensus on the threshold best corresponding to disease extent, due to a lack of truth for validation. The purpose of this investigation was to establish criteria under which a fixed FDG-PET threshold may be useful for target delineation. An image-based surrogate of target definition 'truth' is proposed, derived from a measure of the concordance between multiple expert observers defining the gross tumor volume (GTV) with FDG-PET and CT. A method was developed that can automatically localize these regions and was used to evaluate the coincident FDG uptake threshold.

Methods and Materials: 10 patients with head and neck (H&N) cancers underwent FDG-PET-CT imaging using a hybrid scanner (Biograph 16, Siemens Medical Systems). For each patient, 8 observers specializing in H&N cancers delineated the GTV on concurrently-displayed FDG-PET-CT. Regions of high target definition concordance were localized by forming the union of observer target definitions, applying a gradient filter and selecting an intensity threshold equivalent to 6 of 8 observers. At regions of high concordance not attributable exclusively to CT information, the FDG uptake threshold relative to maximum uptake in the GTV was measured.

Results: In 4 patients, the mean FDG uptake threshold was 40.9%. In regions of concordance not attributable to CT, the mean threshold in 6 patients was 32.8%.

Conclusion: A method was developed for localizing regions of high inter-observer concordance. These regions served as a surrogate truth for disease extent against which FDG-PET uptake thresholds were evaluated. For primary H&N cancers, a threshold of approximately 30-40% was able to delineate the tumor at regions of the target boundary where CT information was not definitive. The application of uniform thresholds for H&N target delineation is not recommended.