AbstractID: 7136 Title: Early assessment of radiotherapy efficacy with FLT-PET imaging

Purpose: Capability to assess treatment response early could dramatically change the practice of radiation therapy as it is performed today. Our aim was to investigate feasibility of repeat 3'-Deoxy-3'-fluorothymidine ([F-18]-FLT) PET/CT imaging as a surrogate for early treatment response.

Materials and Methods: Multiple patients with different tumor types – head and neck, lung, esophagus and CNS – underwent either a radical (6 weeks) or palliative (2 weeks) radio- or chemoradiotherapy. Each patient was imaged twice with FLT-PET/CT, a marker of cell proliferation. The baseline FLT-PET/CT scan was acquired up to a week before the start of radiotherapy or chemoradiotherapy. The follow-up FLT-PET/CT scan was acquired in the first half of therapy, typically after one to two-weeks of radiotherapy. The FLT-PET image acquisition was dynamic over 90 minutes after the injection of FLT. The CT data between the imaging sessions was co-registered and the corresponding PET data compared and analyzed.

Results: The FLT uptake has proved to be high compared to the normal background activity for all investigated tumor types. The absolute FLT uptake varied significantly for different tumor types, with standardized uptake values (SUV) ranging from less than 1 in CNS tumors to over 10 in head and neck and lung tumors. Detectable change in proliferative activity ($>20\%$) was observed within a week of the initiation of therapy. Significant inter- and intra-patient, and high tumor heterogeneity was observed.

Conclusions: FLT-PET/CT imaging is an extremely powerful tool for early assessment of treatment response for a variety of tumor types. While the absolute FLT uptake varied significantly between different tumor types, the signal to background ratio was high. Early treatment assessment is possible as early as one week after the start of therapy. High inter- and intra-patient tumor response variability offers unprecedented possibilities for treatment adaptation.