AbstractID: 9106 Title: Use of FLT-PET imaging to assess tumor and normal tissue response to radiotherapy

Purpose: In radiation therapy, use of 2-Fluoro-2-deoxy-D-glucose (FDG) PET imaging to assess treatment response in tumors and normal tissues is suboptimal because of the confounding effects of radiation-induced inflammation. We have investigated the feasibility of 3'-Deoxy-3'-fluorothymidine (FLT) PET imaging, as a surrogate of cell proliferation, to assess treatment response in tumors and as well as normal tissues.

Materials and methods: Patients receiving radiation therapy were imaged twice with FLT-PET/CT: prior to therapy, and after receiving approximately 10-20 Gy of radiation dose. A 90 minute dynamic FLT-PET image acquisition was initiated after the injection of FLT. The average standardized uptake values (SUV) between 60-90 minutes were used in the analysis. The CT data between the imaging sessions was co-registered and the corresponding PET data compared and analyzed. Both, the tumor region as well as the surrounding normal tissues within the radiation field were analyzed for their response.

Results: The FLT-PET SUVs decreased approximately 20-50% within the first two weeks of radiation therapy, which provides an optimal timing window for treatment response assessment. Of the normal tissues, radiation effects were most notable in bone marrow, because of the high normal FLT uptake. Radiation doses in excess of 10 Gy lead to complete bone marrow ablation, as assessed with FLT-PET imaging. For doses below 10 Gy, an exponential cell-kill relation correlates well with the observed decrease in FLT bone marrow uptake. Radiation effects were observed in other normal tissues as well. However, due to the low baseline FLT uptake, the changes were not readily detectable.

Conclusions: FLT-PET imaging was demonstrated as a powerful tool for early assessment of proliferative response to radiation therapy. Treatment assessment is possible as early as one week after the initiation of therapy. In addition to tumor response, FLT-PET imaging also provides means to assess normal tissue damage.