

AbstractID: 14300 Title: Quantification of response during radiotherapy via PET/CT imaging of proliferation and hypoxia

Purpose: Molecular imaging represents a potential technique to optimize radiotherapy delivery through early response assessment, but no consensus exists on relevant imaging techniques. In this study, we quantified patient response to radiation therapy through PET/CT imaging of proliferation and hypoxia.

Materials and Methods: On a prospective clinical trial, 8 patients with head and neck squamous cell carcinoma (HNSCC) received IMRT to 70 Gy over 7 weeks, with concurrent cisplatin and bevacizumab regimens. PET images were acquired before start of radiation and after 5-10 radiotherapy fractions utilizing [^{18}F]FLT (a proliferation marker) and [^{64}Cu]Cu-ATSM (a hypoxia marker). Images were co-registered by bony anatomy along with treatment planning CTs and target volumes (PTVs exported from planning software). Images were normalized by injected dose and body weight to obtain SUV. Treatment response was assessed in PTV regions using total SUV and peak SUV (defined as the average SUV in a 1 cm³ sphere surrounding the maximum SUV). Quoted values are mean \pm standard error.

Results: Inhibition of tumor proliferation following radiation (measured by FLT PET) was statistically significant in a paired t-test. SUV_{total} decreased from 2400 \pm 1000 to 1500 \pm 700 ($p < 0.001$). Similar trends were found with SUV_{peak} ($p = 0.002$). While group means of CuATSM SUV_{total} decreased post-radiation, from 2000 \pm 800 to 1900 \pm 900, changes were not significant at the $\alpha = 0.05$ level ($p = 0.09$). Similar trends were found with SUV_{peak} ($p = 0.13$).

Conclusion: Decrease in proliferation during radiation was easily measured with FLT PET. Hypoxic uptake did not exhibit a significant change in these pilot data. Ultimately, quantification of proliferative and hypoxic response may be a useful tool for early response assessment and the optimization of radiotherapy delivery in a combined treatment paradigm.

Conflict of Interest: Research sponsored in part by Genentech.