AbstractID: 11098 Title: FLT PET imaging of bone marrow toxicity: an in vivo biodosimeter

Purpose: Accurate dosimetry is critical for effective management of persons exposed to radiation; in many cases this can only be achieved by biodosimetry, measuring the change in a biological parameter correlated to dose received. This study evaluates the suitability of FLT PET imaging as a biodosimeter by investigating the correlation between absorbed dose and FLT uptake in bone marrow in patients undergoing fractionated radiotherapy.

Methods and Materials: Patients received a series of two PET/CT scans using [^{18}F]FLT (a cellular proliferation marker), one prior to the start of radiotherapy and another later in the treatment course (2-3 weeks). The ratio of the bone marrow SUVs of the later scan to the earlier scan was calculated, and the result was used as the surviving fraction in the linear quadratic formalism. A constant α/β ratio of 10 Gy was assumed. Alpha values were calculated for individual bones on a voxel-by-voxel basis, using dose information from the treatment plan. Inter-patient and intra-patient comparisons of the results were made, and the relationship between α and received dose was investigated.

Results: High FLT uptake in bone marrow was observed for all patients in pre-treatment scans, and a negative correlation was observed between dose received and change in bone marrow FLT uptake. Interestingly alpha was observed to decrease with dose. The decrease in α occurs exponentially, with the extrapolation value at zero of $0.15 Gy^{-1}$ and the exponential dose decay constant of $0.5 Gy^{-1}$. Intra-patient variability suggests that the calculation is sensitive to the image registration techniques employed.

Conclusions: FLT-PET imaging shows great potential for use as a biodosimeter; these results suggest that a correlation exists between change in FLT uptake and absorbed dose. Further study is needed to assess the sensitivity of these calculations both to setup errors and to different image processing techniques.